PB90-166455

# Proposed Best Demonstrated Available Technology (BDAT) Background Document for Miscellaneous Halogenated Organic Wastes, Wastes of a Pharmaceutical Nature, Brominated Organic Wastes, Organo-Sulfur Compound Wastes, and Organo-Nitrogen Compound Wastes. Volume 7

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This document provides the Agency's rationale and technical support for developing treatment standards for the wastes listed in Table 1-1. Section 2.0 of this document presents the approximate number and geographic distribution of facilities that may be affected by the land disposal restrictions, the processes generating these wastes, and available waste characterization data.

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# PROPOSED

# BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

# BACKGROUND DOCUMENT

# FOR

# MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

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November 1989

Note: This proposed Background Document is being issued in support of the Agency's proposed rulemaking for the land disposal restrictions program. The Agency solicits comments on the proposed rule and on this proposed Background Document. This document will be issued in final form, appropriately revised in response to comments, at the time of promulgation of the final rule.

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# 1.0 INTRODUCTION

## 1.1 Regulatory Background

Section 3004(m) of the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA) on November 8, 1984, requires the U.S. Environmental Protection Agency (EPA or the Agency) to promulgate treatment standards for certain hazardous wastes based on the Best Demonstrated Available Technology (BDAT) for those wastes. More than 500 of these hazardous wastes were listed as of December 1988 (see Title 40, Code of Federal Regulations, Part 261 (40 CFR Part 261)). The Agency divided the listed hazardous wastes into five groups. The wastes in each group are examined to determine whether further land disposal is protective of human health and the environment (see 40 CFR Part 268). The five groups and their respective dates of promulgation of treatment standards are:

| | |
|---|---|
| o Solvent and dioxin wastes | November 7, 1986 |
| o "California List" wastes | July 8, 1987 |
| o "First Third" wastes | August 8, 1988 |
| o "Second Third" wastes | June 8, 1989 |
| o "Third Third" wastes | On or before May 8, 1990 |

Several wastes included in this schedule were regulated ahead of schedule, and several wastes in the "First Third" or "Second Third" group of wastes were deferred to the "Third Third" group of wastes. Treatment standards for the Third Third wastes will become effective no later than May 8, 1990. On and after this date, wastes regulated in the "Third Third" rulemaking will have to comply with applicable treatment standards prior to "land disposal" as defined in 40 CFR Part 268.

Treatment standards are specified for both nonwastewater and wastewater forms of each listed hazardous waste. In general, numerical treatment standards were developed for wastes that are amenable to quantification in hazardous waste matrices, and treatment standards specifying methods of treatment were developed for wastes that are not amenable to quantification in hazardous waste matrices using current analytical methods. These standards are applicable to the wastes as listed as well as to any wastes generated by the management or treatment of the listed waste. For the purpose of determining the applicability of the treatment standards, wastewaters are defined as wastes containing less than 1% (weight basis) total suspended solids[*] and less than 1% (weight basis) total organic carbon (TOC). Wastes not meeting the wastewater definition must comply with treatment standards for nonwastewaters.

The specific waste codes that are the subject of this document are listed in Table 1-1 by waste code and include U and P wastes. Table 1-1 also lists the constituents for which the wastes are listed. These wastes have been combined into five waste treatability groups:

---

[*] The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, total suspended solids are measured by Method 209c (Total Suspended Solids Dried at 103 to 105°C in Standard Methods for the Examination of Water and Wastewater (Reference 1).

- Miscellaneous Halogenated Organic Wastes;
- Wastes of a Pharmaceutical Nature;
- Brominated Organic Wastes;
- Organo-sulfur Compound Wastes; and
- Organo-nitrogen Compound Wastes.

The identification of these treatability groups is discussed in Section 2.3. This background document provides the Agency's rationale and technical support for selecting constituents being proposed for regulation and for developing treatment standards for these wastes. This document also provides waste characterization data that serve as a basis for determining whether a variance from treatment standards may be warranted for a particular miscellaneous halogenated organic waste, waste of a pharmaceutical nature, brominated organic waste, organo-sulfur compound waste, or organo-nitrogen compound waste that is more difficult to treat than the wastes that were tested and from which treatment performance data were used to develop the treatment standards for the wastes included in this background document.

U and P wastes consist of a commercial chemical product or manufacturing intermediate from a non-specific source containing any of the chemicals listed in 40 CFR 261.33(e) or (f) and in which the listed chemical is the sole active ingredient. Commercial chemical products or manufacturing intermediates include all commercially pure grades of the listed chemical, all technical grades, and all formulated products in which the listed chemical is the sole active ingredient (but not products containing mixtures of listed commercial chemicals). In addition, an off-specification product that, if it met specification, would have the generic name included in either 261.33(e) or (f) is a U or P waste. Any residue that is a listed chemical remaining in a container or inner liner removed from a container that will not be recycled, reclaimed, or reused; or any residue or contaminated soil, water, or debris from a spill of such a chemical, is also a U or P waste. However, these wastes do not include manufacturing process wastes. A U or P waste is either:

- Discarded or intended to be discarded;
- Mixed with another material and applied to the land for dust suppression or road treatment;
- Applied to land in lieu of its original intended use; or
- Distributed or burned as a fuel or fuel additive.

U wastes are identified as toxic; P wastes are identified as acutely hazardous. Whether a waste is acutely hazardous or toxic generally has no bearing on its treatability.

## 1.2 Document Summary

This document provides the Agency's rationale and technical support for developing treatment standards for the wastes listed in Table 1-1. Section 2.0 of this background document presents the approximate number and geographic distribution of facilities that may be affected by the land disposal restrictions, the processes generating these wastes, and available waste characterization data. The Agency estimates that there are approximately 675 facilities that may be affected by this rule. The four-digit Standard Industrial Classification (SIC) codes associated with the organic chemicals industry is 2869 (Industrial Organic Chemicals, Not Elsewhere Classified). Section

Halogen organic wastes +
Pharmaceutical wastes.

→ cont'd on pg 1-5

con't from pg 1-4

2.0 also includes EPA's rationale for combining certain waste codes into the five treatability groups.

EPA's rationale for identifying BDAT for wastes included in this document is presented in Section 3.0. Specifically, BDAT has been identified to be incineration for nonwastewater forms of these wastes and incineration for wastewater forms of these wastes that are amenable to quantification in waste treatment residual matrices. BDAT for wastewater forms of these wastes that cannot be quantified in hazardous waste matrices using current analytical methods is wet air oxidation followed by carbon adsorption, chemical oxidation followed by carbon adsorption, or incineration. In addition, biological treatment followed by carbon adsorption is also BDAT for wastewater forms of these wastes (other than those included in the miscellaneous halogenated organic treatability group) that cannot be quantified in hazardous waste matrices using current analytical methods.

Alternate concentration-based treatment standards for all U and P wastewaters have also been developed based on additional wastewater treatment data from several technologies. These data and the corresponding treatment technologies are discussed in Reference 3 and are included in Sections III.A.2.a.(3.) and III.A.1.h.(b.) of the preamble.

Section 4.0 contains treatment performance data that the Agency has used to determine BDAT and proposed treatment standards for the wastes included in this document. The Agency has treatment performance data for

→ con't on pg 1-7

nonwastewaters and wastewaters from 14 incineration tests performed by EPA for the BDAT program. Recently, additional wastewater treatment data, primarily from EPA's Office of Water, have been analyzed for the development of concentration-based treatment standards for many of the U and P wastes. These data include treatment performance data for wastewaters that are not specifically listed as U or P wastewaters, but do contain many of the corresponding U and P waste constituents. While these data were not available in time for incorporation into the preamble discussion or into this background document for specific wastes or waste treatability groups, these data are being placed in the administrative record for this rulemaking. Furthermore, the Agency has decided to propose alternative concentration-based treatment standards, based on the aforementioned data, for all U and P wastewaters for which standards based on incinerator scrubber waters have been proposed. Further information on these alternative standards can be found in sections III.A.2.a(3.) and III.A.1.h.(b.) of the preamble for the proposed rule and in the document Best Demonstrated Available Technology (BDAT) Background Document for Wastewaters Containing BDAT List Constituents (Reference 3).

The Agency is transferring treatment performance data from incineration of ethylene dibromide to wastes included in the brominated organic wastes treatability group for the purpose of developing numerical treatment standards. These data are included in Section 4.0. The Agency is also transferring treatment performance data from incineration of benzal chloride in K015 and of p-dichlorobenzene in K019 for the purpose of developing numerical treatment standards for U017. These data are also included in Section 4.0.

The Agency is also in the process of conducting wastewater treatment tests for selected U and P chemicals using wet air oxidation, powdered activated carbon treatment (PACT), and carbon adsorption. Since much of the currently available wastewater treatment data is from the treatment of relatively low concentrations of U and P waste constituents in industrial wastewaters, these tests have been designed to examine the applicability of treatment technologies to wastewaters containing relatively high concentrations of U and P constituents. The data developed in these studies are included in the administrative record for inspection and comment. Further information on the availability of the wastewater treatment test data can be found in section III.A.1.h.(6.) of the preamble for the proposed rule.

EPA's rationale for selecting constituents for proposed regulation by means of numerical treatment standards is presented in Section 5.0. Due to the lack of characterization data for U and P wastewaters and nonwastewaters, only the constituent for which the waste was listed was considered for regulation. However, many of these U and P waste constituents cannot be quantified in hazardous waste matrices using current analytical methods. In these cases, the Agency is specifying a method of treatment as the BDAT treatment standard since, without analytical methods, establishing concentration-based treatment standards for the waste's constituents would not be appropriate.

Section 6.0 includes the determination of proposed treatment standards for the miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, brominated organic wastes, organo-sulfur compound wastes, and organo-nitrogen compound wastes. Tables 1-2 through 1-6 at the end of this section present the proposed treatment standards developed for these wastes. The units used for total constituent concentration of organic constituents are mg/kg (parts per million on a weight-by-weight basis) for the nonwastewater forms of these wastes, and mg/l (parts per million on a weight-by-volume basis) for the wastewater forms of these wastes. BDAT treatment standards for P and U wastes included in this document were determined based on treatment performance data from the 14 incineration tests discussed in Section 4.0. Alternative treatment standards for U and P wastewaters were determined based on treatment performance data from several sources of wastewater treatment data, as discussed in the Wastewater Background Document (Reference 3).

The Agency is proposing two regulatory options for U017: (1) development of numerical treatment standards for benzal chloride based on those developed for benzal chloride in K015 and (2) specifying a method of treatment as the BDAT treatment standard for U017. The Agency is proposing both options since benzal chloride is relatively unstable in water and analysis of this compound in treatment residuals may not be reproducible. The Agency is requesting comment on the reproducibility of analysis of benzal chloride and the proposed regulatory options for U017.

Section 7.0 acknowledges the persons involved in developing the regulation of these wastes. Section 8.0 includes references cited in this document. Appendix A includes chemical structures for the U and P wastes included in this document. Appendix B includes plant codes cited in this document. Appendix C includes relevant QA/QC information corresponding to treatment performance data presented in Section 4.0. Appendix D includes variability factor calculations corresponding to treatment standard calculations presented in Section 6.0. Additional treatment performance data are included in Appendix E.

## Table 1-1

## WASTES INCLUDED IN THIS BACKGROUND DOCUMENT

| Waste Code | Constituent |
|---|---|
| P002 | 1-Acetyl, 2-thiourea |
| P007 | 5-Aminoethyl-3-isoxazolol |
| P008 | 4-Aminopyridine |
| P014 | Thiophenol (Benzenethiol) |
| P016 | Bis-(chloromethyl)ether |
| P017 | Bromoacetone |
| P018 | Brucine |
| P022 | Carbon disulfide |
| P023 | Chloroacetaldehyde |
| P024 | p-Chloroaniline |
| P026 | 1-(o-Chlorophenyl)thiourea |
| P027 | 3-Chloroproprionitrile |
| P028 | Benzyl chloride |
| P042 | Epinephrine |
| P045 | Thiofanox |
| P046 | alpha,alpha-Dimethylphenethylamine |
| P049 | 2,4-Dithiobiuret |
| P054 | Aziridine |
| P057 | 2-Fluoroacetamide |
| P058 | Fluoroacetic acid |
| P064 | Isocyanic acid, methyl ester |
| P066 | Methomyl |
| P067 | 2-Methylaziridine |
| P069 | Methyllactonitrile |
| P070 | Aldicarb |
| P072 | 1-Naphthyl-2-thiourea |
| P075 | Nicotine and salts |
| P077 | p-Nitroaniline |
| P082 | N-Nitrosodimethylamine |
| P084 | N-Nitrosomethylvinylamine |
| P093 | N-Phenylthiourea |
| P095 | Phosgene |
| P101 | Ethyl Cyanide (Propanenitrile) |
| P108 | Strychnine and salts |
| P116 | Thiosemicarbazide |
| P118 | Trichloromethanthiol |
| U003 | Acetonitrile |
| U006 | Acetyl chloride |
| U007 | Acrylamide |
| U009 | Acrylonitrile |
| U010 | Mitomycin C |
| U011 | Amitrole |
| U012 | Aniline |
| U014 | Auramine |
| U015 | Azaserine |

Table 1-1 (Continued)

WASTES INCLUDED IN THIS BACKGROUND DOCUMENT

| Waste Code | Constituent |
|---|---|
| U017 | Benzal chloride |
| U020 | Benzenesulfonyl chloride |
| U021 | Benzidine |
| U024 | Bis-(2-chloroethoxy)methane |
| U025 | Dichloroethyl ether |
| U026 | Chloronaphazine |
| U027 | Bis-(2-chloroisopropyl)ether |
| U029 | Methyl bromide (Bromomethane) |
| U030 | 4-Bromophenyl phenyl ether |
| U033 | Carbonyl fluoride |
| U034 | Trichloroacetaldehyde |
| U035 | Chlorambucil |
| U041 | n-Chloro-2,3-epoxypropane |
| U042 | 2-Chloroethyl vinyl ether |
| U043 | Vinyl chloride |
| U045 | Chloromethane |
| U046 | Chloromethyl methyl ether |
| U047 | 2-Chloronaphthalene |
| U049 | 4-Chloro-o-toluidine hydrochloride |
| U059 | Daunomycin |
| U062 | Diallate |
| U066 | 1,2-Dibromo-3-chloropropane |
| U067 | Ethylene dibromide (1,2-Dibromomethane) |
| U068 | Dibromomethane |
| U073 | 3,3'-Dichlorobenzidine |
| U075 | Dichlorodifluoromethane |
| U089 | Diethylstilbestrol |
| U090 | Dihydrosafrole |
| U091 | 3,3'-Dimethoxybenzidine |
| U092 | Dimethylamine |
| U093 | p-Dimethylaminoazobenzene |
| U095 | 3,3'-Dimethylbenzidine |
| U097 | Dimethyl carbonyl chloride |
| U105 | 2,4-Dinitrotoluene |
| U106 | 2,6-Dinitrotoluene |
| U110 | Dipropylamine |
| U111 | Di-n-propylnitrosamine |
| U114 | Ethylene bis-dithiocarbamic acid |
| U116 | Ehtylene thiourea |
| U119 | Ethyl methane sulfonate |
| U121 | Fluorotrichloromethane |
| U138 | Iodomethane |
| U141 | Isosafrole |
| U143 | Lasiocarpine |
| U148 | Maleic anhydride |
| U149 | Malonitrile |

Table 1-1 (Continued)

WASTES INCLUDED IN THIS BACKGROUND DOCUMENT

| Waste Code | Constituent |
|---|---|
| U150 | Melphalan |
| U152 | Methacrylonitrile |
| U153 | Methanethiol |
| U155 | Methapyrilene |
| U156 | Methyl chlorocarbonate |
| U158 | 4,4-Methylene-bis-(2-chloroaniline) |
| U163 | N-Methyl-,N-nitro-,N-nitroguanidine |
| U164 | Methylthiouracil |
| U167 | 1-Naphthylamine |
| U168 | 2-Naphthylamine |
| U169 | Nitrobenzene |
| U171 | 2-Nitropropane |
| U172 | N-Nitroso-di-n-butylamine |
| U173 | N-Nitroso-diethanolamine |
| U174 | N-Nitrosodiethylamine |
| U176 | N-Nitroso-N-ethylurea |
| U177 | N-Nitroso-N-methylurea |
| U178 | N-Nitroso-N-methylurethane |
| U179 | N-Nitrosopiperidine |
| U180 | N-Nitrosopyrrolidine |
| U181 | 5-Nitro-o-toluidine |
| U187 | Phenacetin |
| U191 | 2-Picoline |
| U192 | Pronamide |
| U193 | 1,3-Propane sulfone |
| U194 | n-Propylamine |
| U196 | Pyridine |
| U200 | Reserpine |
| U202 | Saccharin and salts |
| U203 | Safrole |
| U206 | Streptozatocin |
| U218 | Thioacetamide |
| U219 | Thiourea |
| U222 | o-Toluidine hydrochloride |
| U225 | Bromoform (Tribromomethane) |
| U234 | sym-Trinitrobenzene |
| U236 | Trypan blue |
| U237 | Uracil mustard |
| U238 | Ethyl carbamate |
| U244 | Thiram |

Table 1-2

## PROPOSED BDAT TREATMENT STANDARDS FOR MISCELLANEOUS HALOGENATED ORGANIC WASTES

NONWASTEWATERS

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/kg) |
|---|---|---|
| P024 | p-Chloroaniline | 16 |
| U017 | Benzal chloride | 6.2 |
| U024 | Bis(2-chloroethoxy)methane | 7.2 |
| U025 | Dichloroethyl ether | 7.2 |
| U027 | Bis(2-chloroisopropyl)ether | 7.2 |
| U043 | Vinyl chloride | 0.035 |
| U045 | Chloromethane | 5.6 |
| U047 | 2-Chloronaphthalene | 5.6 |
| U073 | 3,3'-Dichlorobenzidine | 16 |
| U075 | Dichlorodifluoromethane | 10 |
| U121 | Fluorotrichloromethane | 33 |
| U138 | Iodomethane | 65 |
| U158 | 4,4'-Methylenebis(2-chloroaniline) | 29 |
| U192 | Pronamide | 1.5 |

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P016 | Bis-(chloromethyl)ether | Incineration |
| P023 | Chloroacetaldehyde | " |
| P026 | 1-(o-Chlorophenyl)thiourea | " |
| P027 | 3-Chloropropionitrile | " |
| P028 | Benzyl chloride | " |
| P057 | 2-Fluoroacetamide | " |
| P058 | Fluoroacetic acid | " |
| P095 | Phosgene | " |
| P118 | Trichloromethanethiol | " |
| U006 | Acetyl chloride | " |
| U017 | Benzal chloride | " |
| U020 | Benzenesulfonyl chloride | " |
| U026 | Chloronaphazine | " |
| U033 | Carbonyl fluoride | " |
| U034 | Trichloroacetaldehyde | " |
| U041 | n-Chloro-2,3-epoxypropane | " |
| U042 | 2-Chloroethyl vinyl ether | " |
| U046 | Chloromethyl methyl ether | " |
| U049 | 4-Chloro-o-toluidine hydrochloride | " |
| U062 | Diallate | " |
| U097 | Dimethyl carbonyl chloride | " |
| U156 | Methyl chlorocarbonate | " |
| U222 | o-Toluidine hydrochloride | " |

## Table 1-2 (Continued)

## PROPOSED BDAT TREATMENT STANDARDS FOR MISCELLANEOUS HALOGENATED ORGANIC WASTES

### WASTEWATERS*

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/L) |
|---|---|---|
| P024 | p-Chloroaniline | 0.28 |
| U017 | Benzal chloride | 0.28 |
| U024 | Bis(2-chloroethoxy)methane | 0.064 |
| U025 | Dichloroethyl ether | 0.013 |
| U027 | Bis(2-chloroisopropyl)ether | 0.064 |
| U043 | Vinyl chloride | 0.033 |
| U045 | Chloromethane | 0.023 |
| U047 | 2-Chloronaphthalene | 0.073 |
| U073 | 3,3'-Dichlorobenzidine | 0.22 |
| U075 | Dichlorodifluoromethane | 0.14 |
| U121 | Fluorotrichloromethane | 0.13 |
| U138 | Iodomethane | 0.23 |
| U158 | 4,4'-Methylenebis(2-chloroaniline) | 0.74 |
| U192 | Pronamide | 0.039 |

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P016 | Bis-(chloromethyl)ether | Wet Air Oxidation Followed by Carbon Adsorption OR Chemical Oxidation Followed by Carbon Adsorption OR Incineration |
| P023 | Chloroacetaldehyde | |
| P026 | 1-(o-Chlorophenyl)thiourea | |
| P027 | 3-Chloropropionitrile | |
| P028 | Benzyl chloride | |
| P057 | 2-Fluoroacetamide | |
| P058 | Fluoroacetic acid | |
| P095 | Phosgene | |
| P118 | Trichloromethanethiol | |
| U006 | Acetyl chloride | |
| U017 | Benzal chloride | |
| U020 | Benzenesulfonyl chloride | |
| U026 | Chloronaphazine | |
| U033 | Carbonyl fluoride | |
| U034 | Trichloroacetaldehyde | |
| U041 | n-Chloro-2,3-epoxypropane | |
| U042 | 2-Chloroethyl vinyl ether | |

Table 1-2 (Continued)

## PROPOSED BDAT TREATMENT STANDARDS FOR MISCELLANEOUS HALOGENATED ORGANIC WASTES

### WASTEWATERS* (Continued)

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| U046 | Chloromethyl methyl ether | Wet Air Oxidation<br>Followed by<br>Carbon Adsorption<br>OR<br>Chemical Oxidation<br>Followed by<br>Carbon Adsorption<br>OR<br>Incineration |
| U049 | 4-Chloro-o-toluidine hydrochloride | |
| U062 | Diallate | |
| U097 | Dimethyl carbonyl chloride | |
| U156 | Methyl chlorocarbonate | |
| U222 | o-Toluidine hydrochloride | |

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* Alternate standards for these U and P wastewaters are also proposed and are presented in Section III.A.7 of the preamble as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. Additional information concerning these alternative standards is included in Section III.A.1.h.(6.)(b.) of the preamble.

## Table 1-3

## PROPOSED BDAT TREATMENT STANDARDS FOR WASTES OF A PHARMACEUTICAL NATURE

### NONWASTEWATERS

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/kg) |
|---|---|---|
| U141 | Isosafrole | 2.6 |
| U155 | Methapyrilene | 6.9 |
| U187 | Phenacetin | 16 |
| U203 | Safrole | 22 |

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P007 | 5-Aminoethyl-3-isoxazolol | Incineration |
| P042 | Epinephrine | " |
| P075 | Nicotine and salts | " |
| P108 | Strychnine and salts | " |
| U010 | Mitomycin C | " |
| U015 | Azaserine | " |
| U035 | Chlorambucil | " |
| U059 | Daunomycin | " |
| U089 | Diethylstilbestrol | " |
| U090 | Dihydrosafrole | " |
| U143 | Lasiocarpine | " |
| U150 | Melphalan | " |
| U163 | N-Methyl-,N-nitro-,N-nitroguanidine | " |
| U164 | Methylthiouracil | " |
| U200 | Reserpine | " |
| U202 | Saccharin and salts | " |
| U206 | Streptozatocin | " |
| U237 | Uracil mustard | " |

Table 1-3 (Continued)

## PROPOSED BDAT TREATMENT STANDARDS FOR WASTES OF A PHARMACEUTICAL NATURE

### WASTEWATERS[*]

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/L) |
|---|---|---|
| U141 | Isosafrole | 0.076 |
| U155 | Methapyrilene | 0.15 |
| U187 | Phenacetin | 0.36 |
| U203 | Safrole | 1.3 |

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P007 | 5-Aminoethyl-3-isoxazolol | Wet Air Oxidation<br>Followed by<br>Carbon Adsorption<br>OR<br>Chemical Oxidation<br>Followed by<br>Carbon Adsorption<br>OR<br>Biodegradation<br>Followed by<br>Carbon Adsorption<br>OR<br>Incineration |
| P042 | Epinephrine | |
| P075 | Nicotine and salts | |
| P108 | Strychnine and salts | |
| U010 | Mitomycin C | |
| U015 | Azaserine | |
| U035 | Chlorambucil | |
| U059 | Daunomycin | |
| U089 | Diethylstilbestrol | |
| U090 | Dihydrosafrole | |
| U143 | Lasiocarpine | |
| U150 | Melphalan | |
| U163 | N-Methyl-,N-nitro-,N-nitroguanidine | |
| U164 | Methylthiouracil | |
| U200 | Reserpine | |
| U202 | Saccharin and salts | |
| U206 | Streptozatocin | |
| U237 | Uracil mustard | |

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[*] Alternate standards for these U and P wastewaters are also proposed and are presented in Section III.A.7 of the preamble as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. Additional information concerning these alternative standards is included in Section III.A.1.h.(6.)(b.) of the preamble.

## Table 1-4

## PROPOSED BDAT TREATMENT STANDARDS FOR BROMINATED ORGANIC WASTES

### NONWASTEWATERS

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/kg) |
|---|---|---|
| U029 | Methyl bromide (Bromomethane) | 15 |
| U030 | 4-Bromophenyl phenyl ether | 15 |
| U066 | 1,2-Dibromo-3-chloropropane | 15 |
| U067 | Ethylene dibromide (1,2-Dibromomethane) | 15 |
| U068 | Dibromomethane | 15 |
| U225 | Bromoform (Tribromomethane) | 15 |

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P017 | Bromoacetone | Incineration |

## Table 1-4 (Continued)
## PROPOSED BDAT TREATMENT STANDARDS FOR BROMINATED ORGANIC WASTES

### WASTEWATERS*

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/L) |
|---|---|---|
| U029 | Methyl bromide (Bromomethane) | 16 |
| U030 | 4-Bromophenyl phenyl ether | 16 |
| U066 | 1,2-Dibromo-3-chloropropane | 16 |
| U067 | Ethylene dibromide (1,2-Dibromomethane) | 16 |
| U068 | Dibromomethane | 16 |
| U225 | Bromoform (Tribromomethane) | 16 |

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P017 | Bromoacetone | Wet Air Oxidation Followed by Carbon Adsorption<br>OR<br>Chemical Oxidation Followed by Carbon adsorption<br>OR<br>Biodegradation Followed by Carbon adsorption<br>OR<br>Incineration |

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* **Alternate standards for these U and P wastewaters** are also proposed and are presented in Section III.A.7 of the preamble as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. Additional information concerning these alternative standards is included in Section III.A.1.h.(6.)(b.) of the preamble.

## Table 1-5

## PROPOSED BDAT TREATMENT STANDARDS FOR ORGANO-SULFUR COMPOUND WASTES

### NONWASTEWATERS

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P002 | 1-Acetyl, 2-thiourea | Incineration |
| P014 | Thiophenol (Benzenethiol) | " |
| P022 | Carbon disulfide | " |
| P045 | Thiofanox | " |
| P049 | 2,4-Dithiobiuret | " |
| P066 | Methomyl | " |
| P070 | Aldicarb | " |
| P072 | 1-Naphthyl-2-thiourea | " |
| P093 | N-Phenylthiourea | " |
| P116 | Thiosemicarbazide | " |
| U114 | Ethylene bis-dithiocarbamic acid | " |
| U116 | Ethylene thiourea | " |
| U119 | Ethyl methane sulfonate | " |
| U153 | Methanethiol | " |
| U193 | 1,3-Propane sulfone | " |
| U218 | Thioacetamide | " |
| U219 | Thiourea | " |
| U244 | Thiram | " |

### WASTEWATERS

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P002 | 1-Acetyl, 2-thiourea | Wet Air Oxidation Followed by Carbon Adsorption OR Chemical Oxidation Followed by Carbon Adsorption OR Biodegradation Followed by Carbon Adsorption OR Incineration |
| P014 | Thiophenol (Benzenethiol) | |
| P022 | Carbon disulfide | |
| P045 | Thiofanox | |
| P049 | 2,4-Dithiobiuret | |
| P066 | Methomyl | |
| P070 | Aldicarb | |
| P072 | 1-Naphthyl-2-thiourea | |
| P093 | N-Phenylthiourea | |
| P116 | Thiosemicarbazide | |
| U114 | Ethylene bis-dithiocarbamic acid | |
| U116 | Ethylene thiourea | |
| U119 | Ethyl methane sulfonate | |
| U153 | Methanethiol | |
| U193 | 1,3-Propane sulfone | |
| U218 | Thioacetamide | |
| U219 | Thiourea | |
| U244 | Thiram | |

## Table 1-6

## PROPOSED BDAT TREATMENT STANDARDS FOR ORGANO-NITROGEN COMPOUND WASTES

### NONWASTEWATERS

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/kg) |
|---|---|---|
| P077 | p-Nitroaniline | 28 |
| P082 | n-Nitrosodimethylamine | 56 |
| P101 | Ethyl cyanide (Propanenitrile) | 360 |
| U003 | Acetonitrile | 0.35 |
| U009 | Acrylonitrile | 0.28 |
| U012 | Aniline | 14 |
| U093 | p-Dimethylaminoazobenzene | 29 |
| U105 | 2,4-Dinitrotoluene | 140 |
| U106 | 2,6-Dinitrotoluene | 28 |
| U111 | Di-n-propylnitrosamine | 14 |
| U152 | Methacrylonitrile | 84 |
| U167 | 1-Naphthylamine | 15 |
| U168 | 2-Naphthylamine | 15 |
| U169 | Nitrobenzene | 14 |
| U172 | n-Nitroso-di-n-butylamine | 54 |
| U174 | n-Nitrosodiethylamine | 28 |
| U179 | n-Nitrosopiperidine | 220 |
| U180 | n-Nitrosopyrrolidine | 220 |
| U181 | 5-Nitro-o-toluidine | 56 |
| U196 | Pyridine | 16 |

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P008 | 4-Aminopyridine | Incineration |
| P018 | Brucine | " |
| P046 | alpha,alpha-Dimethylphenethylamine | " |
| P054 | Aziridine | " |
| P064 | Isocyanic acid, methyl ester | " |
| P067 | 2-Methylaziridine | " |
| P069 | Methyllactonitrile | " |
| P084 | N-Nitrosomethylvinylamine | " |
| U007 | Acrylamide | " |
| U011 | Amitrole | " |

Table 1-6 (Continued)

## PROPOSED BDAT TREATMENT STANDARDS FOR ORGANO-NITROGEN COMPOUND WASTES

### NONWASTEWATERS (Continued)

Maximum for any single grab sample

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| U014 | Auramine | Incineration |
| U021 | Benzidine | " |
| U091 | 3,3'-Dimethoxybenzidine | " |
| U092 | Dimethylamine | " |
| U095 | 3,3'-Dimethylbenzidine | " |
| U110 | Dipropylamine | " |
| U148 | Maleic anhydride | " |
| U149 | Malonitrile | " |
| U171 | 2-Nitropropane | " |
| U173 | N-Nitroso-diethanolamine | " |
| U176 | N-Nitroso-N-ethylurea | " |
| U177 | N-Nitroso-N-methylurea | " |
| U178 | N-Nitroso-N-methylurethane | " |
| U191 | 2-Picoline | " |
| U194 | n-Propylamine | " |
| U234 | sym-Trinitrobenzene | " |
| U236 | Trypan blue | " |
| U238 | Ethyl carbamate | " |

### WASTEWATERS *

Maximum for any single grab sample

| Waste Code | Constituent | Total Concentration (mg/L) |
|---|---|---|
| P077 | p-Nitroaniline | 0.25 |
| P082 | n-Nitrosodimethylamine | 0.67 |
| P101 | Ethyl cyanide (Propanenitrile) | 0.64 |
| U003 | Acetonitrile | 0.42 |
| U009 | Acrylonitrile | 0.64 |
| U012 | Aniline | 0.033 |
| U093 | p-Dimethylaminoazobenzene | 0.74 |
| U105 | 2,4-Dinitrotoluene | 0.17 |
| U106 | 2,6-Dinitrotoluene | 0.051 |
| U111 | Di-n-propylnitrosamine | 0.065 |
| U152 | Methacrylonitrile | 0.47 |
| U167 | 1-Naphthylamine | 0.37 |
| U168 | 2-Naphthylamine | 1.8 |
| U169 | Nitrobenzene | 0.033 |
| U172 | n-Nitroso-di-n-butylamine | 0.67 |
| U174 | n-Nitrosodiethylamine | 0.67 |
| U179 | n-Nitrosopiperidine | 1.3 |
| U180 | n-Nitrosopyrrolidine | 1.3 |
| U181 | 5-Nitro-o-toluidine | 2.2 |
| U196 | Pyridine | 0.031 |

Table 1-6 (Continued)

## PROPOSED BDAT TREATMENT STANDARDS FOR ORGANO-NITROGEN COMPOUND WASTES

### WASTEWATERS[*] (Continued)

Maximum for any single grab sample

| Waste Code | Constituent | BDAT Technology |
|---|---|---|
| P008 | 4-Aminopyridine | Wet Air Oxidation<br>Followed by<br>Carbon Adsorption<br>OR<br>Chemical Oxidation<br>Followed by<br>Carbon Adsorption<br>OR<br>Biodegradation<br>Followed by<br>Carbon Adsorption<br>OR<br>Incineration |
| P018 | Brucine | |
| P046 | alpha,alpha-Dimethylphenethylamine | |
| P054 | Aziridine | |
| P064 | Isocyanic acid, methyl ester | |
| P067 | 2-Methylaziridine | |
| P069 | Methyllactonitrile | |
| P084 | N-Nitrosomethylvinylamine | |
| U007 | Acrylamide | |
| U011 | Amitrole | |
| U014 | Auramine | |
| U021 | Benzidine | |
| U091 | 3,3'-Dimethoxybenzidine | |
| U092 | Dimethylamine | |
| U095 | 3,3'-Dimethylbenzidine | |
| U110 | Dipropylamine | |
| U148 | Maleic anhydride | |
| U149 | Malonitrile | |
| U171 | 2-Nitropropane | |
| U173 | N-Nitroso-diethanolamine | |
| U176 | N-Nitroso-N-ethylurea | |
| U177 | N-Nitroso-N-methylurea | |
| U178 | N-Nitroso-N-methylurethane | |
| U191 | 2-Picoline | |
| U194 | n-Propylamine | |
| U234 | sym-Trinitrobenzene | |
| U236 | Trypan blue | |
| U238 | Ethyl carbamate | |

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[*] Alternate standards for these U and P wastewaters are also proposed and are presented in Section III.A.7 of the preamble as standards for the corresponding chemical in wastewater forms of Multi-source Leachate. Additional information concerning these alternative standards is included in Section III.A.1.h.(6.)(b.) of the preamble.

## 2.0 INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

This section describes the industries affected by the land disposal restrictions for the wastes listed in Table 1-1, the processes generating the wastes, the available characterization data, and the determination of waste treatability groups.

### 2.1 Industry Affected

Industries that generate these wastes listed in Table 1-1 include the organic chemical, pharmaceutical, dye and pigment, textile and fiber, pesticide, and rubber industries. Table 2-1 identifies the industrial uses of the commercial chemical products included in each waste treatability group identified in Section 2.3 Table 2-2 summarizes the total number of facilities that may generate each waste code. The number of facilities that may generate the waste codes are listed by state and by EPA region in Table 2-3.

### 2.2 Waste Characterization

P wastes include discarded commercial chemical products, manufacturing chemical intermediates, off-specification commercial chemical products, container residues, and spill residues, including contaminated water, soil, or debris, that are identified as acutely hazardous wastes. U wastes include discarded commercial chemical products, manufacturing chemical intermediates, off-specification commercial chemical products, and spill residues, including contaminated water, soil, or debris, that are identified as toxic wastes. Due to the diversity of methods of waste generation, the composition of these wastes varies greatly. The constituents of concern may be present at concentrations varying from several parts per million to nearly 100% in virtually pure product. Waste characterization data are not available for any of the waste codes included in this document. Section 1.0 discusses the definition of U and P wastes in greater detail.

## 2.3 Determination of Waste Treatability Groups

The wastes included in this document were combined into treatability groups based on similarities in elemental composition and functional groups present within the structure of the chemical. The industries that generate these wastes were also considered in establishing these groups.

The wastes were combined into five treatability groups:

- Miscellaneous Halogenated Organic Wastes;
- Wastes of a Pharmaceutical Nature;
- Brominated Organic Wastes;
- Organo-sulfur Compounds Wastes; and
- Organo-nitrogen Compounds Wastes.

The specific waste codes included within each treatability group are listed in Table 2-4.

### 2.3.1 Miscellaneous Halogenated Organic Wastes

EPA grouped halogenated organic wastes (except brominated organic wastes) that were not included in other waste treatability groups addressed in the Third Third group of wastes, such as certain halogenated pesticides and certain halogenated aliphatics, into the miscellaneous halogenated organics treatability group. These wastes represent a wide range of chemicals produced in a variety of industries as presented in Table 2-1; however, all of these wastes appear to be amenable to treatment by the demonstrated technologies identified in Section 3.0. The miscellaneous halogenated organic waste codes include the following general chemical structures, as discussed below:

- Chlorinated Diphenyls;
- Chlorinated Polynuclear Aromatics;
- Chlorinated Amines, Amides, and Nitriles;
- Chlorinated Methylbenzenes;
- Halogenated Aliphatics;
- Halogenated Aldehydes, Ethers, and Esters; and
- Halogenated Organosulfur Compounds.

#### Chlorinated Diphenyls

Diphenyls are compounds consisting of two benzene rings attached to a single, common carbon atom. (Diphenyls are not to be confused with biphenyls, which have the structure of two benzene rings attached directly to each other.) The chlorinated diphenyls represented by these waste codes differ from those previously mentioned in the halogenated pesticide category (e.g., DDD, DDT, and Methoxychlor) because these diphenyls contain fewer chlorine atoms and also include methylene and amine functional groups. Both U073 and U158 are amenable to quantification in hazardous waste matrices.

### Chlorinated Polynuclear Aromatics

Chlorinated polynuclear aromatics are chemicals that contain fused aromatic rings with one having only one attached chlorine while the other has an attached chlorinated amine functional group. Only U047 is amenable to quantification in hazardous waste matrices.

### Chlorinated Amines, Amides, and Nitriles

These waste codes were grouped together because they contain an amine, amide, or nitrile group attached to a relatively simple hydrocarbon structure. Only P024 and U192 are amenable to quantification in hazardous waste matrices.

### Chlorinated Methylbenzenes

P028 and U017 were grouped together because they both consist of a toluene moiety with chlorines attached to the methyl group. Waste constituents in P028 and U017 may not be amenable to quantification in many hazardous waste matrices using current analytical methods. Nevertheless, since the Agency developed numerical treatment standards for benzal chloride in K015 wastes, the Agency is transferring these data to U017 for the purpose of developing numerical treatment standards. The Agency is soliciting comment on the reproducibility of analysis of benzal chloride in treatment residues and the establishment of numerical treatment standards for benzyl chloride.

### Halogenated Aliphatics

These waste codes were grouped together because they have one, two, or three carbon atoms with at least one chlorine, fluorine, iodine, or nitrile group attached. All of these waste constituents, with the exception of P027, are amenable to quantification in hazardous waste matrices.

### Halogenated Aldehydes, Ethers, and Esters

These waste codes are relatively simple oxygenated hydrocarbons with various degrees of halogenation. Only U024, U025, U027, and U042 are amenable to quantification in hazardous waste matrices.

### Halogenated Organosulfur Compounds

These waste codes were grouped together because they are chlorinated organosulfur compounds. None of these waste constituents are amenable to quantification in hazardous waste matrices.

### 2.3.2 Wastes of a Pharmaceutical Nature

Waste codes included in this treatability group are wastes associated with the pharmaceutical industry or wastes that are similar to pharmaceutical wastes. All of the waste constituents included in this group are large, complex, heavily-substituted molecules. Almost all of the waste constituents are aromatic with nitrogen- or sulfur-heterocyclic structures or polynuclear aromatic structures. All of the waste constituents have multiple double bonds and include oxygen, nitrogen, or sulfur atoms. Only U141, U155, U187, and U203 are amenable to quantification in hazardous waste matrices.

### 2.3.3 Brominated Organic Wastes

The waste codes included in this treatability group include brominated hydrocarbons and oxygenated hydrocarbons. The Agency believes that the presence of bromine in the chemical structure may require modified design and carefully controlled operation of the incineration system. Therefore, these wastes have been combined in a separate brominated organics treatability group. All of these waste constituents, with the exception of P017, are amenable to quantification in hazardous waste matrices.

### 2.3.4 Organo-sulfur Compound Wastes

The waste codes included in this treatability group include organosulfur compounds which were not included in other waste treatability groups.

These wastes represent a wide range of chemicals produced in a variety of industries, as discussed in Section 2.1; however, all of these wastes are amenable to treatment by the demonstrated technologies identified in Section 3.0. Only P014 and P022 are amenable to quantification in hazardous waste matrices.

### 2.3.5 Organo-nitrogen Compound Wastes

EPA grouped all remaining non-halogenated wastes containing nitrogen functional groups which were not included in other waste treatability groups addressed in the Third Third group of wastes, such as halogenated pesticides and halogenated aliphatics, into the organo-nitrogen compound treatability group. These wastes represent a wide range of chemicals produced in a variety of industries, as discussed in Section 2.1; however, all of the wastes are amenable to treatment by the demonstrated technologies identified in Section 3.0. The waste codes in the organo-nitrogen compound treatability group include the following general chemical structures, as discussed below:

- Nitrogen Heterocyclics;
- Amines and Amides;
- Aminated Diphenyls and Biphenyls;
- Nitriles;
- Nitro Compounds; and
- Nitroso Compounds.

#### Nitrogen Heterocyclics

These waste codes were grouped together because they contain a ring of carbon atoms which also includes a nitrogen atom. Three waste constituents have aromatic rings while six have rings comprised of single bonds. Only U179, U180, and U196 are amenable to quantification in hazardous waste matrices.

### Amines and Amides

These waste codes were grouped together because they contain amine or amide groups. Two constituents have fused aromatic rings, four contain single benzene rings, three contain amine groups attached to aliphatic carbon chains, and three have amide groups attached to ether bonds or to double carbon bonds. U007, U012, U167, and U168 are amenable to quantification in hazardous waste matrices.

### Aminated Diphenyls and Biphenyls

These waste codes were grouped together because they contain a biphenyl skeleton - two benzene rings joined by a single bond or bridged by a single carbon or by a nitrogen-nitrogen double bond. Each biphenyl has at least one amine functional group. Trypan blue has a complex structure including a binuclear double benzene ring on each phenyl with $NaO_3S$ moieties on each double benzene ring. U091, U093, and U095 are amenable to quantification in hazardous waste matrices; however, the Agency was unable to develop numerical treatment standards for U091 and U095 due to the lack of analytical data for these waste constituents.

## Nitriles

These waste codes are grouped together because they contain nitrile groups, which consist of a nitrogen atom triply bonded to a carbon atom. All are straight-chain aliphatics, two have a carbon-carbon double bond in the chain, and one has two attached nitrile groups. P101, U003, U009, and U152 are amenable to quantification in hazardous waste matrices.

## Nitro Compounds

These waste codes were grouped together because they contain at least one nitro functional group, which is a nitrogen atom attached to two oxygen atoms. Seven have single benzene rings, and one has a three-carbon aliphatic chain. P077, U105, U106, U169, and U181 are all amenable to quantification in hazardous waste matrices.

## Nitroso Compounds

These waste codes were grouped together because they contain a nitroso functional group, which is a nitrogen atom bonded to a second nitrogen atom that is double bonded to an oxygen atom. All of these waste constituents are small aliphatic molecules; four have oxygen functional groups which as amides, ethers, and ketones. P082, U111, U172, and U174 are amenable to quantification in hazardous waste matrices.

TABLE 2-1

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| **MISCELLANEOUS HALOGENATED ORGANIC WASTES - GROUP 1 (CHLORINATED DIPHENYLS)** | | |
| U073 3,3'-Dichlorobenzidine | | Curing agent |
| | Dyes and Pigments | Paint and ink formulation |
| | Dyes and Pigments | Manufacture of AZO dyes |
| | Dyes and Pigments | Chemical intermediate for dyes |
| | Plastics | Plastic compounding ingredient |
| | Rubber | Rubber compounding ingredient |
| U158 4,4-Methylene-bis-(2-chloroaniline) | | Components in home appliances |
| | | Manufacture of radar systems |
| | | Manufacture of gun mounts |
| | Aircraft | Manufacture of jet engine turbine blades |
| | Plastics and Resins Manufacturing | Curing agent |
| **MISCELLANEOUS HALOGENATED ORGANIC WASTES - GROUP 2 (CHLORINATED POLYNUCLEAR AROMATICS)** | | |
| U026 Chloronaphazine | Medicine | Antineoplastic agent (not in U.S.) |
| U047 2-Chloronaphthalene | | No information available |
| **MISCELLANEOUS HALOGENATED ORGANIC WASTES - GROUP 3 (CHLORINATED AMINES, AMIDES, AND NITRILES)** | | |
| P024 p-Chloroaniline | Agricultural Chemicals | Chemical intermediate for urea herbicides |
| | Dyes and Pigments Manufacturing | Chemical intermediate for dyes and pigments |
| P057 2-Fluoroacetamide | Pesticides | Insecticide |
| | Pesticides | Rodenticide |
| U049 4-Chloro-o-toluidine hydrochloride | Dyes and Pigments | Produce AZO dyes for cotton,silk,acetate,nylon |
| | Dyes and Pigments | Chemical intermediate for dyes |
| U097 Dimethyl carbonyl chloride | | Chemical intermediate for parasympathomimetic agents |
| | Pesticides | Pesticide (former use) |
| U192 Pronamide | Agricultural Chemical | Herbicide for vegetables |
| U222 o-Toluidine hydrochloride | Dyes and Pigments | Chemical intermediate for dyes |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| MISCELLANEOUS HALOGENATED ORGANIC WASTES - GROUP 4 (CHLORINATED METHYLBENZENES) | | |
| P028 Benzyl chloride | Specialty Chemical | Chemical intermediate for other benzyl phthalates |
| | Agricultural Chemicals | Manufacture of baterícides |
| | Specialty Chemical | Chemical intermediate for n-butyl benzyl phthalate |
| | Flavoring | Manufacture of flavors and odorants |
| | Specialty Chemical | Manufacture of benzyl compounds |
| | Cosmetics and Fragrances | Manufacture of perfumes |
| | Pharmaceuticals | Manufacture of pharmaceutical products |
| | Specialty Chemical | Synthesis of tribenzyltin chloride |
| | Dyes and Pigments | Manufacture of synthetic tannins |
| | | Pickling inhibitors |
| | Photography | Manufacture of photographic developer |
| | Specialty Chemical | Blocking agent to monoalkylated piperazine |
| | Dyes and Pigments | Manufacture of dyes |
| | Specialty Chemical | Conversion of tertiary amines to quaternary ammonia chlorides |
| | Lubricant Manufacturing | Manufacture of lubricants |
| | Plastics and Resins | Manufacture of artificial resins |
| | | Production of electron-beam-sensitive fluid media |
| | Agricultural Chemicals | Manufacture of fungicides |
| | Pesticides | Manufacture of insecticides |
| | Petroleum Refining | Gasoline gum inhibitor |
| | Pharmaceuticals | Penicillin precursors |
| | Plastics and Resins | Manufacture of plastics and plasticizers |
| | Rubber | Rubber accelerators |
| U017 Benzal chloride | Specialty Chemical | Preparation of benzoyl chloride |
| | Specialty Chemical | Manufacture of cinnamic acid |
| | Specialty Chemical | Chemical intermediate for benzaldehyde |
| | Dyes and Pigments Manufacturing | In dyes |
| MISCELLANEOUS HALOGENATED ORGANIC WASTES - GROUP 5 (HALOGENATED ALIPHATICS) | | |
| P027 3-Chloroproprionitrile | Specialty Chemical | Combines reactivity of nitrile and an alkyl halide |
| | Pharmaceuticals Manufacturing | Pharmaceutical and polymer synthesis |
| U043 Vinyl chloride | Plastics | Monomer/comonomer for polyvinyl chloride |
| | Textiles and Fibers | Monomer and comonomer for fibers |
| | | Chemical intermediate |
| | Adhesive and Sealants Industry | Plastic adhesive |
| | Automobile Manufacturing | No information available |
| | Building and Construction | Production vinyl asbestos floor tiles |
| | Electrical Equipment | Insulation for electrical wire,cable,piping |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U043 (continued) | Glass | No information available |
| | Packaging | Food, medical supplies |
| | Paper | No information available |
| | Plastics | Organic synthesis of plastics |
| | Rubber | No information available |
| U045 Chloromethane | | Manufacturing of methyl cellulose |
| | | Manufacturing of tetramethylead |
| | | Methylating agent |
| | | Propellant |
| | Agricultural Chemicals | Herbicide |
| | Agricultural Chemicals | Manufacturing of fumigants |
| | Pharmaceuticals | Anesthetic |
| | Plastics | Foaming agent |
| | Rubber | Manufacturing of synthetic rubbers |
| | Rubber | Solvent and diluent in butyl rubber production |
| | Rubber | Production of silicone resins and rubbers |
| | Steel | Foaming agent stainless steel |
| | Timber | Processing of timber products |
| | | Extractant for oils, fats and resins |
| | | Fluid for thermometric & thermostatic equipment |
| | | Chemical intermediate |
| | | Terminates polymerization of bakelite polysulfone |
| U075 Dichlorodifluoromethane | Health and Safety | Leak-detecting agent |
| | | Refrigerant |
| | Plastics | Polymerization catalyst |
| | Adhesive and Sealants Industry | Aerosol propellent |
| | Agricultural Chemicals | Aerosol propellent |
| | Automobile Manufacturing | Refrigerant for air conditioning |
| | Bottle Manufacturing | No information available |
| | Cosmetics Manufacturing | Aerosol propellent |
| | Electrical Equipment | Manufacturing electrical insulation and generator windings |
| | Food Processing | Solvent or diluent in fumigants for food sterilization |
| | Food Processing | Freezing of foods |
| | Food Service/Restaurant | Chilling of glasses |
| | Medicine | Preparation of frozen tissue sections |
| | Metals Manufacturing | Copper and aluminum purification |
| | Organic Chemicals | Synthesis of Freons |
| | Paint Manufacturing and Application | Used in paints & varnish removers |
| | Paint Manufacturing and Application | Aerosol propellant |
| | Petroleum Refining | Petroleum recovery |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U075 (continued) | Pharmaceutical Manufacturing | Aerosol propellant |
| | | Refrigerant in home & commercial applications |
| | Plastics | Used in polymerization process |
| | | Aerosol propellant in cleaners |
| | | Working fluid for heat pumps and in hydraulic fluids |
| | | Used in regulating devices for leak detection |
| | | Foaming agent for surfactants |
| | | Foaming agent in fire extinquishers |
| | | Water purification |
| | | Used in thermal expansion valves |
| U121 Fluorotrichloromethane | | Sulfonation solvent in chemical synthesis |
| | | Dielectric fluid in bubble chambers in wind tunnels |
| | | Aerosol propellant |
| | | Blowing agent in production of polyurethane foam |
| | | Production of polymeric resins |
| | | Chemical intermediate |
| | Agricultural Chemicals | Aerosol propellant |
| | Cosmetic and Fragrance | Aerosol propellant |
| | Electrical Equipment | Electric insulation |
| | Food Processing | No information available |
| | Organic Chemicals | Manufacture cleaning compounds |
| | Paint Manufacturing and Application | Aerosol propellant |
| | Pharmaceuticals | Aerosol propellant |
| | | Manufacture fire extinquishers |
| | | Aerosol propellant (floor waxes) |
| | | Refrigerant |
| | | Solvent and degreasing agent |
| U138 Iodomethane | | Chemical intermediate for methylamines & quarternary ammonium iodides |
| | | Chemical intermediate for for phosponium iodides |
| | | Chemical intermediate for organometallics |
| | | Alkylating agent |
| | Pharmaceuticals | Methylating agent in prep. pharmaceutical intermediates |
| | | Microscopy |
| | | Building block for radioactive tracers synthesis |
| | | Testing for pyridine |
| | | As imbedding material of diatom examination |
| | | As fire extinquisher |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| MISCELLANEOUS HALOGENATED ORGANIC WASTES - GROUP 6 (HALOGENATED ALDEHYDES, ETHERS, AND ESTERS) | | |
| P016 Bis-(chloromethyl)ether | Specialty Chemical | Lab reagent |
| | Plastics | Alkylating agent in manufacture of polymers |
| | Specialty Chemical | Monitoring indicator for chloromethyl ether |
| | Specialty Chemical | Intermediate in synthesis of anionic exchange strong-base resins |
| P023 Chloroacetaldehyde | Rubber | Bark removal from trees |
| | Specialty Chemical | Chemical intermediate |
| | Water Treatment | Control of algae,bacteria,and fungi in water |
| | Specialty Chemical | In manufacture of 2-aminothiazole |
| | Agricultural Chemicals | Fungicide |
| | Dentistry | As spinning solution of poly B-aniline |
| P058 Fluoroacetic acid | Pesticides | Rodenticide |
| | Pesticides | Predacide (predatory animals) |
| P095 Phosgene | | Monomer for polycarbonate resins |
| | Specialty Chemical | Chemical intermediate for toluene diisocyanate |
| | Specialty Chemical | Chemical intermediate for methyl isocyanate |
| | | War gas |
| | Specialty Chemical | Chemical intermediate for polymethylene polyphenylisocyanate |
| | Specialty Chemical | Intermediate, carbonylating agent |
| | Specialty Chemical | Chemical intermediate for diethyl carbonate,dimethyl carbamoyl chloride |
| | Specialty Chemical | Chemical intermediate for diphenylmethane-4,4'-diisocyanate |
| | Specialty Chemical | Chemical intermediate for acyl chlorides, chloroformate esters |
| | Dyes and Pigments | Production of aniline dyes |
| | Organic Chemicals Manufacturing | Preparation of organic chemicals |
| U006 Acetyl chloride | | Catalyst in chlorination of acetic acid |
| | | Production of acetamide |
| | | Production of acetyl sulfide |
| | Medicine | Testing for cholesterol |
| | | Determination of water in inorganic liquid |
| | | Chemical intermediate acetanilide preparation |
| | | Chemical intermediate acetophenone reparation |
| | Laboratory | Qualitative organic analysis |
| | Specialty Chemical | Synthesis of dienestrol diacetate |
| | Specialty Chemical | Production of thioacetic acid |
| | | Chlorinating agent inorganic compounds and triarylcarbinols |
| | | Acetylating agent |
| | Dyes and Pigments | Manufacture dyestuffs |
| | Pharmaceuticals | Pharmaceuticals manufacturing |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | | INDUSTRY | USE(a) |
|---|---|---|---|
| U024 | Bis(2-chloroethoxy)methane | | Solvent |
| | | Rubber | Chemical intermediate for polysulfide rubber |
| U025 | Dichloroethyl ether | Petroleum | Scavenge lead deposits in gasoline |
| | | Agricultural Chemicals | Soil fumigant (former use) |
| | | Agricultural Chemicals | Control earworms on corn (former use) |
| | | Organic Chemicals | Chemical intermediate & cross-linker |
| | | Pesticides | Acaricide (former use) |
| | | Petroleum Refining | Purification of oils |
| | | Pharmaceuticals | Anesthetic |
| | | Textiles | Scouring of textiles |
| | | | Used in aerosols |
| | | Lubricant | General/selective solvent production lubricating oils |
| | | | In Kier boiling |
| U027 | bis-(2-chloroeisopropyl)ether | | Chemical intermediate |
| | | | In paint and varnish removers |
| | | | Spotting and cleaning solutions |
| | | | Solvent for fats, waxes, grease |
| | | Textiles | Textile processing |
| U033 | Carbon fluoride | Petroleum | Chemical intermediate in organic synthesis |
| U034 | Trichloroacetaldehyde | | Induce swelling of starch granules |
| | | | Spraying and pouring of polyurethanes |
| | | | Chemical intermediate for chloral hydrate |
| | | | Chemical intermediate for herbicide trichloroacetic acid |
| | | Pesticides | Intermediate in manufacture of DDT,methoxychlor,DDVP,naled,trichlorofon |
| U041 | n-Chloro-2,3-epoxypropane | | Scavenging additive to trichloroethylene |
| | | | Preparation of condensates with polyfunctional substances |
| | | | Chemical intermediate for glycidyl acrylate and glycidyl methacrylate |
| | | | Polymer coating materials in water supply systems |
| | | Plastics | Reactive plasticizer |
| | | | High wet-strength resins for paper industry |
| | | | Solvent for cellulose esters and ethers |
| | | Plastics and Resins | Comonomer for unmodified epoxy resins |
| | | Plastics and Resins | Preparation of ion exchange resins,elastomers,solvents,plasticizers |
| | | | Chemical intermediate for polythiols |
| | | | Cross-linking agent for hydrogel sheet for temporary wound dressing |
| | | | Solvent for lacquers,cement for celluloid |
| | | | Solvent for natural & synthetic resins,gums,cellulose esters & ethers |
| | | Paints | Solvent for paints,varnishes,nail enamels |
| | | | Stabilizer in chlorine-containing material |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U041 (continued) | | Intermediate in the production of beta-blocker, aryloxypropanolamine |
| | | Comonomer for polyamide-epichlorohydrin resins |
| | | In formation of polythioaldane carboxylic acid oligomers in hair shampoo |
| | | Cross-linking agent for cyclodextrins |
| | | Production of poly(oxlyalkylene)ether derivatives |
| | | Co-stabilizer to enhance mixed-metal combination |
| | Plastics and Resins | Raw material for epoxy & phenoxy resins |
| | | Cross-linking agent in microencapsulation |
| | | Chemical intermediate for alkyl glyceryl ether sulfonate surfactants |
| | | Raw material for glycerol and glycidol derivatives |
| | | Chemical intermediate for glycidyl ethers,glycerin |
| | | Monomer or comonomer in epichlorohydrin elastomers |
| | | Manufacture of glycerol |
| | Agricultural Chemicals | Sporicide |
| | Hair products | Cross-linking agent in starch |
| | Optics | Chemical intermediate for quaternary ammonium salts |
| | Pesticides | Insect fumigant |
| | Pesticides | Stable insecticide emulsion |
| | Pharmaceuticals | Manufacture of pharmaceuticals |
| | Plastics and Resins | Heat stabilizer for plastics |
| | Rubber | Curing propylene-based rubbers |
| U042 2-Chloroethyl vinyl ether | Fibers | Copolymer with ethyl acrylate to produce acrylic elastomer |
| | Pharmaceuticals | Chemical intermediate for anesthetics, sedatives, & cellulose ethers |
| U046 Chloromethyl methyl ether | | Industrial polymers |
| | | Alkylating agent & solvent in manufacture of water repellants |
| | | Intermediate in synthesis of chloromethylated compound |
| | | Preparation of ion-exchange resins |
| | | Chemical intermediate for dodecylbenzyl chloride |
| U156 Methyl chlorocarbonate | | In organic synthesis |
| | Pesticides | In insecticides |
| MISCELLANEOUS HALOGENATED ORGANIC WASTES - GROUP 7 (HALOGENATED ORGANOSULFUR COMPOUNDS) | | |
| P026 1-(o-Chlorophenyl)thiourea | | Not manufactured or used industrially in U.S. |
| P118 Trichloromethanethiol | | No information available |
| U020 Benzenesulfonyl chloride | Specialty Chemical | Chemical intermediate for benzonitrile |
| | Specialty Chemical | Chemical intermediate for thiophenol |
| | Specialty Chemical | Chemical intermediate for glybuzole |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U020 (continued) | Specialty Chemical | Chemical intermediate for benzene sulfonamides |
| | Specialty Chemical | Esters formerly used as insecticides,miticides,fenson acaricide |
| | Specialty Chemical | Chemical intermediate for N-2-chloroethyl amides |
| | Laboratory | Reagent for Freiedl-Crafts sulfonulation |
| U062 Diallate | Agricultural Chemicals | Sprout inhibitor |
| | Agricultural Chemicals | Herbicide |
| WASTES OF A PHARMACEUTICAL NATURE | | |
| P007 5-Aminoethyl-3-isoxazolol | | Laboratory use |
| | Medicine | Antiemetic |
| P042 Ephinephrine | Medicine | To counter allergic reactions, prolong infiltration anesthetics |
| | Medicine | Adrenergic agent |
| | Medicine | Sympathomimetic, vasconstrictor, cardiac stimulant, bronchodilator |
| P075 Nicotine | Leather and Tanning | In tanning |
| | Agricultural Chemicals | Greenhouse fumigant |
| | Pesticides | Insecticide |
| | Veterinary Medicine | Ectoparasitic, anthelmintic |
| P108 Strychnine | Pesticides | Destroying predatory animals and trapping fur-bearing animals |
| | Pesticides | Rodent control in forage crops production |
| | Pesticides | Rodent control in fruit production |
| U010 Mitomycin C | Medicine | Medication |
| U015 Azaserine | Medicine | Research chemical |
| | Pharmaceuticals/Medicine | Antineoplastic agent, antibiotic, abortifacient, antifungal |
| U035 Chlorambucil | | Not produced in U.S. (imported from U.K.) |
| | Medicine | Antineoplastic agent: leukemia,Hodgkins disease,malignant lymphomas,etc. |
| | Veterinary Medicine | Antineoplastic agent |
| U059 Daunomycin | | Antineoplastic agent, antibiotic (not produced in U.S.) |
| U089 Diethylstilbestrol | Pharmaceuticals/Medicine | No longer used |
| U090 Dihydrosafrole | | Chemical intermediate for piperonyl butoxide (not in U.S.) |
| | Flavor | Flavoring agent in root beer |
| | Cosmetics and Fragrances | Fragrance for cosmetics |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U141 Isosafrole | Cosmetic and Fragrance | In root beer (former use) and sarsaparilla flavors<br>Manufacture heliotropin<br>Chemical intermediate for dihydrosafrole (not in U.S.)<br>Manufacture pesticide synergists<br>Modify oriental perfumes |
| U143 Lasiocarpine | Medicine | Research chemical |
| U150 Melphalan | Medicine | Antineoplastic agent |
| U155 Methapyrilene | Pharmaceuticals<br>Pharmaceuticals<br>Veterinary Medicine | Sedative in sleeping aids<br>Antihistaminic<br>Antihistaminic agent |
| U163 N-Methyl,N-nitro-,N-nitroguanidine | Medicine | Laboratory preparation of diazomethane (former use)<br>Research chemicals |
| U164 Methylthiouracil | Human/Veterinary Medicine | Anti-thyroid agent (Not produced in U.S.) |
| U187 Phenacetin | Hair Products<br>Pharmaceuticals/Veterinary Medicine | Stabilizer for hydrogen peroxide in hair bleaching preparation<br>Analgesic and antipyretic |
| U200 Reserpine | Pharmaceuticals | Medication |
| U202 Saccharin | Animal Food Products<br>Electroplating<br>Food Products | Cattle feed additive<br>Electroplating bath additive<br>Non-caloric synthetic sweetener -- food, gum, toothpaste, smokeless tobacco, etc. |
| U203 Safrole | Adhesives and Sealants<br>Cosmetics<br>Pesticides<br>Pharmaceuticals<br>Pharmaceuticals | Chemical intermediate for heliotropin<br>Chemical intermediate ofr isosafrole<br>Manufacture of piperonyl butoxide<br>As preservative in mucilage and library paste<br>Fragrance for cosmetics<br>Pediculicide<br>Flavoring agent for drugs, topical antiseptic<br>Carminative |
| U206 Streptozatocin | Medicine<br>Medicine<br>Veterinary Medicine (Research) | Antineoplastic agent in cancer treatment<br>Experimental use in diabetes & as antimicrobial agent<br>Diabetogenic agent |
| U237 Uracil Mustard | Medicine | Antineoplastic agent (essentially obsolete drug) |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| BROMINATED ORGANIC WASTES | | |
| P017 Bromoacetone | Plastics | Organic synthesis |
| | Munitions | Chemical war gas |
| | Munitions | Tear gas |
| U029 Methyl bromide | Food | Food sterilization |
| | Food | Extraction of oils from nuts, seeds, flowers |
| | | Fire extinquisher |
| | | Refrigerant |
| | | In ionization chambers |
| | | Degreasing wool |
| | Agricultural Chemicals | Fumigant for soil |
| | Dyes and Pigments | Solvent in aniline dyes |
| | Pesticides | Insect and rodent control in space and commodity fumigations |
| | Pharmaceuticals | Methylating agent |
| U030 4-Bromophenyl phenyl ether | Chemical Research | Not in U.S. |
| U066 1,2-Dibromo-3-chloropropane | | Intermediate in organic synthesis |
| | | Commercial preparation for flame retardant |
| | Agricultural Chemicals | Soil fumigant (not in U.S.) |
| | Agricultural Chemicals | Soil fumigant for pineapple in Hawaii |
| U067 Ethylene dibromide | Agricultural Chemicals | Quarantine fumigant some fruits & veg. |
| | Plastics and Resins | Solvent for resins,gums,waxes |
| | | Chemical intermediate and in gauge fluids |
| | | Vault fumigation |
| | | Catalyst in preparation of Grignard reagents |
| | | Chemical intermediate for vinyl bromide |
| | Dyes and Pigments | Chemical intermediate for dyes |
| | Food Processing | Spot fumigation milling machinery |
| | Pesticides | Termite and japanese beetle control |
| | Pesticides | Insecticidal fumigant for stored products |
| | Pesticides | Beehive supers |
| | Pesticides | Soil treatment (insects and nematodes) |
| | Pharmaceuticals | Chemical intermediate for pharmaceuticals |
| | Timber | Felled log fumigation |
| U068 Dibromomethane | | Organic synthesis |
| | | Gauge fluid |
| | | Ingredient of fire-estinquishing fluids |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U068 (continued) | | Heavy liquid in solid separations |
| | Plastics and Resins | Solvent for waxes & resins |
| U225 Bromoform | | Ingredient in fire-resistant chemicals |
| | | Chemical intermediate for organic synthesis |
| | | Solvent in liquid-solvent extractions |
| | | Flotation agent in sedimentary petrographical surveys |
| | | Catalyst/sensitizer in polymer reactions |
| | | Solvent for waxes,greases,& oils |
| | | Flotation agent in purification of materials (quartz) |
| | | Flotation agent in mineral separation |
| | | In gauge fluid |
| | | Reagent for graphite ore fractionation |
| | | Solvent in nuclear magnetic resonance studies |
| | Aircraft/Aerospace | No information available |
| | Pharmaceuticals | Sedative |
| | Pharmaceuticals | Synthesis of pharmaceuticals |
| | Rubber | Catalyst/sensitizer in vulcanization of rubber |
| | Shipbuilding | No information available |
| ORGANO-SULFUR COMPOUND WASTES | | |
| P002 1-Acetyl-2-thiourea | | No information available |
| P014 Thiophenol (Benzenethiol) | Agricultural Chemicals, Pesticides | Chemical intermediate for carbophenothion fungicide<br>Chemical intermediate for carbophenothion insecticide & acaricide |
| P022 Carbon disulfide | Clothing | Chemical intermediate for rayon |
| | Automobile Manufacturing | Corrosion inhibitor |
| | Metals Recovery | Agent in removal of metals form waste water |
| | Wood, Housing | Putty preservatives |
| | Lubricants, Wax, Soap, Margarine | Tallow |
| | Chemical | Catalyst and catalyst adjuvant and activator |
| | Specialty Chemical | Dissolving free sulfur,phosphorous,iodine |
| | | Regenerator for transition metal sulfide catalysts |
| | | Manufacture of xanthogenates |
| | | Xanthation of cellulose in preparation of viscose |
| | | Flame lubricant in cutting glass |
| | Plastics | Chemical intermediate for cellophane |
| | | Solvent for phosphorous,selenium,bromine,iodine,fats & resins |
| | Specialty Chemical | Chemical intermediate for carbon tetrachloride |
| | Medicine | Optical glass |
| | Electroplating | Agent in metal treatment and plating (gold and nickel) |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| P022 (continued) | Plastics | Polymerization inhibitor for vinyl chloride |
| | Electronic | Electronic vacuum tubes |
| | | Solvent for cleaning and extractions |
| | Petroleum | Generating petroleum catalysts |
| | | Solvent for waxes,lacquers,camphor,resins,vulcanized rubber |
| | | Chemical intermediate for sulfur and carbonyl sulfide,xanthates |
| | Rubber | Rubber cement |
| | Adhesives and Sealants | Chemical intermediate for adhesives for food packaging |
| | Adhesives and Sealants | Preservation of fresh fruit |
| | Agricultural Chemicals | Solvent in extraction of growth inhibitors |
| | Explosive | Explosives |
| | Film | Development restrainer for instant color photography |
| | Pesticides | Solvent for pesticide intermediates |
| | Pesticides | Fumigant |
| | Pesticides | Seed treatment on conifers |
| | Pesticides | Soil disinfectants |
| | Pesticides | Rocket fuel |
| | Petroleum Refining | Paints,enamels,varnishes,paint removers |
| | Plastics and Resins | Chemical intermediate for rubber compounds |
| | Rubber | Cold vulcanization of rubber |
| | Rubber | Veterinary anthelmintic |
| P045 Thiofanox | Pesticides | Systemic soil insecticide |
| | Pesticides | Acaricide and nematocide (soil & seed treatment) |
| P049 2,4-Dithiobiuret | Pesticides | Manufacture of insecticides, rodenticides |
| | Plastics and Resins | Plasticizer, intermediate in resin manufacture |
| | Rubber | Rubber accelerator |
| P066 Methomyl | Pesticides | Nematocide, insecticide |
| P070 Aldicarb | Pesticides | Insecticide, acaracide, nematocide |
| P072 1-Naphthyl-2-thiourea | Pesticides | Rodenticide for Norway rat (former use) |
| P093 N-Phenylthiourea | Medicine | In genetics research |
| | Agricultural Chemicals | Rabbit,rat,weasel repellent |
| P116 Thiosemicarbazide | | Reagent for ketones and certain metals |
| | Agricultural Chemicals | Chemical intermediate for herbicides |
| | Agricultural Chemicals | Fungicide for rice |
| | Pesticides | Rodenticide |
| | Photography | No information available |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U114 Ethylene bis-dithiocarbamic acid | Agricultural Chemicals | Heavy metal salts as fungicides |
| U116 Ethylene thiourea | | Electroplating baths |
| | | Intermediate for antioxidants |
| | Agricultural Chemicals | Intermediate for fungicides |
| | Dyes and Pigments | Intermediate for dyes |
| | Pesticides | Intermediate for insecticides |
| | Pharmaceuticals | Intermediate for pharmaceuticals |
| | Plastics and Resins | Manufacture of synthetic resins |
| | Rubber | Accelerator for neoprene rubbers |
| U119 Ethyl methane sulfonate | Biochemical Research | Not produced in U.S. |
| U153 Methanethiol | Flavor | Synthetic flavoring and adjuvants |
| | | Synthesis of methimine |
| | | Synthetic flavoring substances and adjuvants |
| | | Catalyst |
| | | Gas odorant for hazardous gases |
| | | Catalyst |
| | | Synthesis of methimine |
| | Agricultural Chemicals | Intermediate in fungicides |
| | Pesticides | Intermediate in pesticide manufacture |
| | Pesticides | Intermediate in pesticide manufacture |
| | Petroleum Refining | Intermediate in jet fuels manufacture |
| | Plastics and Resins | Intermediate in plastics manufacture |
| U193 1,3-Propane sulfone | | Confer water solubility and anionic character |
| | | Chemical intermediate to sulfopropyl group |
| U218 Thioacetamide | Leather, Textiles, Paper | Solvent |
| | | Stabilizer for fuel with tetraethyllead |
| | | Substitute for H2S in labs |
| | | Solubilizer for riboflavin |
| | Medicine | Analytical reagent |
| | Rubber | Accelerator for buna rubber |
| U219 Thiourea | | Removal of mercury from wastewaters |
| | Cosmetics | In hair preparations |
| | | Preparation of non-glare mirrors |
| | Paper Manufacturing | In paper whiteners |
| | Wood Preserving | Stain prevention of hemlock wood |
| | | In scrub soln for waste gas containing NO(X)&SO(X) |
| | Paper | Stabilizer for diazo coating solns for copy film & paper |
| | | Reagent for bismuth, selenite ions |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U219 (continued) | Adhesives and Sealants | Liquifier/peptizing agent for glue |
| | | In dry-cleaning chemicals |
| | | Chelating agent |
| | | Synthesis of sulfthiazole |
| | | Catalyst in isomerization of maleic to fumaric acid |
| | | Intermediate for 5-Iodo-2-thiouracil |
| | | In cleaning and plating baths for metals |
| | Textiles | Manufacture of fire retardant for lacy fabrics |
| | | Metal corrosion inhibitor for pickling solutions |
| | | Radioprotector in X-irradiated mice |
| | | Reduces interferences for analysis of cadmium |
| | | Vulcanization accelerator |
| | | In mineral oil |
| | Agricultural Chemicals | Fungicide |
| | Agricultural Chemicals | Sprout accelerator in dormant tubers |
| | Dyes and Pigments | Dye intermediate |
| | Photography | Photographic fixing agent and remove stains from negatives |
| | Photography | Complexing agent for color print photography |
| | Pesticides | Synthesis of insecticides |
| | Pharmaceuticals | Synthesis of pharmaceuticals |
| | Plastics and Resins | Manufacture of resins |
| | Textiles | In-boiler water treatment |
| | Textiles | Flame-proofing agent for nylon |
| | Textiles | Weighting agent for silk |
| | Veterinary Medicine | Experimentally as thyroid inhibitor or goitrogen |
| | Veterinary Medicine | Medication |
| U244 Thiram | | Peptizer for polysulfide elastomer |
| | Agricultural Chemicals | Fungicide for industrial textiles |
| | Wood Preserving | Preservative |
| | | Activator for guanidine,amine,& thiazole cure systems |
| | Food Products | Mushroom disinfectant |
| | | Antioxidant in polyolefins |
| | Rubber | Vulcanizing agent for rubber |
| | Agricultural Chemicals | Fungicide for use on paper, polyurethane foam products |
| | Pharmaceuticals | Bacteriostat in soap and antiseptic sprays |
| | | Activator for sulfenamide accelerators |
| | Agricultural Chemicals | Fungicide for seed treatment |
| | Agricultural Chemicals | Animal repellent for trees and shrubs |
| | Rubber | Accelerator for natural & isoprene rubbers,etc. |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

## TABLE 2-1 (Continued)

### INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| **ORGANO-NITROGEN COMPOUND WASTES - GROUP 1 (NITROGEN HETEROCYCLICS)** | | |
| P008 4-Aminopyridine | Plastics | Solvents, reagents and chemicals |
| P018 Brucine | Specialty Chemical | Reagent for separating racemic mixtures |
| | Specialty Chemical | Denaturant for ethanol |
| P054 Aziridine | Specialty Chemical | In binders |
| | Plastics | Comonomer for polymers |
| | Specialty Chemical | Monomer for polyethyleneimine |
| | Specialty Chemical | As flocculation aids |
| | Specialty Chemical | In surfactants |
| | Specialty Chemical | In ion exchange resins |
| | Specialty Chemical | Chemical intermediate for N-(2-hydroxyethyl)ethyleneimine |
| | Paint Manufacturing | In lacquers |
| | Specialty Chemical | Manufacture of trimethylmelanine |
| | Cosmetics | In cosmetics |
| | Specialty Chemical | Manufacture of taurine |
| | Adhesives and Sealants | In adhesives |
| | Agricultural Chemicals | As plant mutagen to improve varieties |
| | Agricultural Chemicals | Exhibits sporicidal action |
| | Photography | In photographic chemicals |
| | Paper | Polymerization products |
| | Pesticides | Control of insect pests by chemosterilization |
| | Petroleum Refining | In petroleum refining chemicals, fuels, oils |
| | Textiles | Strengthening, shrinkproofing, stiffening, flameproofing, waterproofing |
| P067 2-Methylaziridine | Food | Chemical intermediate in gelatins |
| | Specialty Chemical | Comonomer for polymer with methacrylic acid & esters |
| | Specialty Chemical | Chemical intermediate for Tris(2-methyl-1,3,5-triazine |
| | | Fiber modification |
| | Adhesives and Sealants | As polymer |
| | Agricultural Chemicals | In imine derivatives for agricultural chemicals |
| | Dyes and Pigments | As polymer |
| | Film | Chemical intermediate in photography |
| | Oil Additives | Modifiers for viscoscity, high pressure performance, oxidation resist. |
| | Oil Additives | Chemical intermediate for oil additives |
| | Paper | As polymer |
| | Petroleum Refining | Flocculants, modifier for rocket propellent fuels |
| | Pharmaceuticals | Organic intermediate |
| | Pharmaceuticals | In imine derivatives for medicinal chemicals |
| | Plastics and Resins | Chemical intermediate in modification of latex coating resins |
| | Rubber | Organic intermediate |
| | Textiles | As polymer |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE,
BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U011 Amitrole | Agricultural Chemicals | Herbicide for non-crop uses (aquatics, hardwood nursery stock) |
| | Agricultural Chemicals | Cotton defoliant |
| | Agricultural Chemicals | Herbicide for food crops (former use) |
| | Agricultural Chemicals | Plant growth regulator |
| | Photography | Reagent in photography |
| U148 Maleic anhydride | | Synthesis of pyridazine |
| | | Uracil antimetabolite |
| | Agricultural Chemicals | Weed control in mixture with 2,4-D |
| | Agricultural Chemicals | Inhibits plant growth (tobacco, potato & onions) |
| | Agricultural Chemicals | Sugar content stabilizer in beets |
| | Agricultural Chemicals | Fungicidal |
| U179 N-Nitrosopiperidine | | Research chemical |
| U180 N-Nitrosopyrrolidine | | Research chemical |
| U191 2-Picoline | | Chemical intermediate for 2-chloro-6-(trichloromethyl)pyridine |
| | | Organic intermediate for pharmaceuticals,rubber chemicals |
| | | Chemical intermediate for 2-vinylpyridine, herbicide picloram,amprolium |
| | Dyes and Pigments | Intermediate |
| | Plastics and Resins | Intermediate |
| U196 Pyridine | | Solvent reaction medium or catalyst in carbohydrate treatment |
| | | In organic synthesis and analytical chemistry |
| | | As an inhibitor & preparation of inhibitor |
| | Pharmaceuticals | Manufacture vitamins,sulfa drugs,disinfectants |
| | | Chemical intermediate for diquat & paraquat, piperidine |
| | | Solvent for anhydrous mineral salts |
| | | To denature alcohol & antifreeze mixtures |
| | | Reduces nitrogen oxide in flue gas |
| | | Synthesis of piperidine |
| | | Reagent |
| | Agricultural Chemicals | Manufacture fungicides |
| | Dyes and Pigments | Manufacture dyestuffs |
| | Explosives | Manufacture explosives |
| | Food Products | Useful in seafood, smoke falvor, chocolate |
| | Paint Manufacturing | Solvent reaction medium or catalyst in paint manufacture |
| | Petroleum Refining | In oil and gas well drilling |
| | Pharmaceuticals | Chemical intermediate for antihistamines |
| | Pharmaceuticals | Manufacture of stimulants,local anesthetics |
| | Pharmaceuticals | Solvent in drug manufacture |
| | Plastics and Resins | Solvent in manufacture of polyurethane resins |
| | Rubber | No information available |
| | Textiles | Chemical intermediate for water-proofing agents in textiles |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | | INDUSTRY | USE(a) |
|---|---|---|---|
| ORGANO-NITROGEN COMPOUND WASTES - GROUP 2 (AMINES AND AMIDES) | | | |
| P046 | alpha,alpha-Dimethyl phenethylamine | Medicine | No information available |
| P064 | Isocyanic acid, methyl ether | Agricultural Chemicals | Chemical intermediate for carbamate herbicides |
| | | Pesticides | Chemical intermediate for carbamate insecticides |
| U007 | Acrylamide | | Sewage and waste treatment |
| | | | Polyacrylamides manufacturing |
| | | | Flocculating aid for precip. suspended solids from aqueous systems |
| | | | Flocculants |
| | | | Cross-linking agent |
| | | | In soil-conditioning agents |
| | | | In ore processing, adhesives |
| | | Mining | Chemical intermediate in polyacrylamides |
| | | Paper and Textile | Paper and textile sizes |
| | | Building & Construction | Construction of dam foundations & tunnels |
| | | Dyes and Pigments | Synthesis of dyes |
| | | Organic Chemicals Manufacturing | Reactive monomer & intermed. organic chemicals production |
| | | Textiles | Permanent press fabrics |
| U012 | Aniline | | Chemical intermediate for substituted aniline salts |
| | | | Isocyanate synthesis |
| | | | Catalyst and stabilizer for hydrogen peroxide synthesis |
| | | | Chemical intermediate for 4-Anilinophenol |
| | | Solvent | Solvent |
| | | | Vulcanization accelerator |
| | | | Chemical intermediate for hydroquinone |
| | | | Cellulose as a precursor |
| | | Clothing | Manufacture shoe blacks |
| | | | Azeotropic agent in manufact. of anhydrous hydrazine |
| | | | Chemical intermediate for methylenediisocyanate |
| | | | Manufacture isocyanates for urethane foam |
| | | Explosives | Manufacture explosives |
| | | | Manufacture of teryl & optical whitening agents |
| | | | Chemical intermediate for corrosion inhibitors |
| | | Agricultural Chemicals | Manufacture herbicides, fungicides |
| | | Cosmetics/Fragrances | Manufacture perfumes |
| | | Dyes and Pigments | Chemical intermediate for dyes & pigments |
| | | Dyes and Pigments | In situ dyeing agent |
| | | Photography | Manufacture photographic chemicals |
| | | Food Processing | In synthesis of intermediates for artificial sweeteners |
| | | Leather and Tanning | Componentof skin stains |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U012 (continued) | Organic Chemicals | Manufacture of rigid polyurethanes |
| | Paint Manufacturing | Manufacture resins, varnishes |
| | Paint Manufacturing | Paint removers |
| | Paper Manufacturing | Analytical reagent in paper chemistry |
| | Pesticides Manufacturing | Chemical intermediate for pesticides |
| | Petroleum Refining | No information available |
| | Pharmaceutical Manufacturing | Chemical intermediate for pharmaceuticals |
| | Plastics and Resins Manufacturing | Component of lacquers & wood stains |
| | Plastics and Resins Manufacturing | Chemical intermediate for specialty resins & cyclohexylamine |
| | Printing | Printing inks, cloth marking inks |
| | Rubber | Chemical intermediate for rubber processing |
| U092 Dimethylamine | | Reagent for magnesium |
| | | Missile fuel |
| | Dyes and Pigments | Dyes |
| | | Ion exchange agent |
| | | Chemical intermediate for lauryl dimethylamine oxide |
| | Detergents | Manufacture of detergents |
| | | Surfactant |
| | Pharmaceuticals | No information available |
| | Petroleum Refining | Antiknock agent in fuels |
| | Agricultural Chemicals | Attract boll weevils |
| | | Antioxidants |
| | | Dehairing agent |
| | Textiles | Textile chemicals |
| | | Electroplating |
| | | Acid gas absorbent |
| | | Flotation agent |
| | Pesticides | Pesticide propellant |
| | | Chemical intermediate for dimethylformamide, dimethylacetamide |
| | Plastics and Resins | Plasticizer |
| | | Rocket propellant |
| | | Dimethylamine salt of 2,4-D |
| | Film | Photographic chemical |
| | Leather and Tanning | Tanning |
| | Petroleum Refining | Gasoline stabilizer |
| | Rubber | Accelerator in vulcanizing rubber |
| U110 Dipropylamine | | Purification of perfluoro-compounds |
| | | Chemical intermediate for S-propyl-di-n-propylthiocarbamate |
| | Agricultural Chemicals | Chemical intermediate for herbicide S-ethyl-di-n-propylthiocarbamate |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U167 1-Naphthylamine | | Chemical intermediate for imidazoline adrenergic agent |
| | | Chemical intermediate for N-1-Naphthylphthalmic acid herbicide |
| | | Toning prints made with cerium salts |
| | Dyes and Pigments | Chemical intermediate for dyes |
| | Pesticides | Chemical intermediate for 1-Naphthylthiourea rodenticide (former use) |
| | Pesticides | Chemical intermediate for fluoroacetamide miticide (former use) |
| | Rubber | Chemical intermediated for N-Phenyl-1-Naphthylamine rubber antioxidant |
| U168 2-Naphthylamine | | Production 2-chloronaphthylamine |
| | Dyes and Pigments | Former chemical intermediate for dyes |
| | Rubber | Former chemical intermediate for rubber antioxidants |
| | Rubber | Formerly in manufacture of rubber |
| U194 n-Propylamine | Textiles | Chemical intermediate for textile resins |
| | | Chemical intermediate for propyl isocyanate |
| | Dyes and Pigments | Chemical intermediate for dyes |
| | Pesticides | Chemical intermediate for pesticides |
| | Petroleum Refinining | Chemical intermediate for petroleum additives |
| | Pharmaceuticals | Chemical intermediate for drugs |
| | Rubber | Chemical intermediate for rubber chemicals |
| U238 Ethyl carbamate | | Formerly as adjunct to sulfonamide therapy |
| | | Preparation and modification of amino resins |
| | Medicine | Anti-neoplastic agent |
| | | Solvent for barious organic materials |
| | Agricultural Chemicals | Solubilizer and co-solvent for fumigants |
| | Biochemical Research | No information available |
| | Cosmetics | Solubilizer and co-solvent |
| | Pesticides | Solubilizer and co-solvent |
| | Pharmaceuticals | Formerly topical bactericide |
| | Pharmaceuticals | Formerly component sclerosing soln for varicose veins |
| | Pharmaceuticals | Intermediate for pharmaceuticals |
| | Textiles | Chemical intermediate for N-hydroxymethyl derivatives |
| | Veterinary Medicine | Anesthetic, hypnotic, sedative, diuretic |
| ORGANO-NITROGEN COMPOUND WASTES - GROUP 3 (AMINATED DIPHENYLS AND BIPHENYLS) | | |
| U014 Auramine | Dyes and Pigments | Dye for lacquers,pen inks,carbon papers,typewriter ribbons |
| | Pharmaceuticals | Food dye in some countries |
| | | Antiseptic |
| | Dyes and Pigments | Dye for paper,cardboard,textiles,leather,oils,waxes,alcoholic solvents |
| | | Smoke dye |
| | Agricultural Chemicals | Fungicide |
| | Dyes and Pigments | Preparation of solvent yellow 34 |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U021 Benzidine | Food | Reagent for hydrogen peroxide in milk |
| | Paper | Production of security paper |
| | Sugar | Spray reagent for sugars |
| | Medicine | Used to verify TLC bands attributed to blood (former use) |
| | Medicine | Stain in microscopy |
| | Laboratory | Lab agent to detect cyanide & sulfate |
| | Specialty Chemical | Organic synthesis |
| | Printing | Used in security printing |
| | | Liquification meadurement |
| | Plastics | Manufacture of plastic films |
| | Tobacco | Quantitative determination of nicotine |
| | Dyes and Pigments | Chemical intermediate for AZO dyes |
| | Rubber | Stiffening agent in rubber compounding |
| U091 3,3'-Dimethoxybenzidine | | Detection of thiocyanates, nitrites, & some metals |
| | Tanning, Paper, Rubber, Textiles | Dye |
| | Dyes and Pigments | Chemical intermediate in production of O-dianisidine diisocyanate |
| U093 p-Dimethylaminoazobenzene | | Chemical intermediate in dyes and pigments |
| U095 3,3'-Dimethylbenzidine | | Not produced or used in U.S. |
| | | Free chlorine in water |
| | | Reagent for gold detection |
| | | In chlorine test kits & test tapes in clinical laboratories |
| | Dyes and Pigments | Chemical intermediate for AZO dyes |
| | Plastics and Resins | Curing agent for urethane resins |
| U236 Trypan blue | | Biological stain |
| | Dyes and Pigments | Dye for textiles,leather,paper |
| | Medicine | Therapeutic agent for sleeping sickness |
| ORGANO-NITROGEN COMPOUND WASTES - GROUP 4 (NITRILES) | | |
| P069 Methyllactonitrile | Specialty Chemical | Chemical intermediate for methyl methacrylate |
| | Specialty Chemical | Reagent in formation of aldehyde cyanohydrins |
| | Pharmaceuticals | Used to produce a pharmaceutical intermediate |
| | | Stereoselective hydrocyanating reagent |
| | Specialty Chemical | Chemical intermediate for methacrylic acid & higher esters |
| | Petroleum | Complexing agent for metals refining and separation |
| | Pesticides Manufacturing | Manufacture insecticides |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| P101 Propanenitrile | | Solvent, dielectric fluid, intermediate |
| | | Exptl applications: ulcerogen |
| | Specialty Chemical | Chemical intermediate for Di-n-propylamine |
| U003 Acetonitrile | | Deodorizers for specialty naphthas |
| | | Solvent for inorganic compounds |
| | | Specialty solvent |
| | | Polar solvent |
| | | Starting material for many nitrogen-containing compounds |
| | | Recrystallizing steroids |
| | | Extraction of fatty acids from fish liver,animal&veg. oils |
| | | Non-aqueous solvent for inorganic salts |
| | | Brightners for metal |
| | | Chemical intermediate -gamma-naphthaleneacetic acid,etc. |
| | | In miscellaneous operations for cyanide dyes |
| | | Medium for promoting ionization |
| | | In electrodinetic transducers and angular accelerometers |
| | | Solvent in non-aqueous titrations |
| | | Starting material thiamine,acetamidine, etc. |
| | Organic Chemicals | Solvent in hydrocarbon extraction processes |
| | Pesticide Manufacturing | Chemical intermediate-pesticide manufacture |
| | Petroleum Refining | Coloring matter from some petroleum hydrocarbons |
| | Pharmaceuticals/Medicine | Separation of alkaloids from tissue extraction |
| U009 Acrylonitrile | | Chemical intermediate antioxidants synthesis |
| | | In co-polymers with styrene and butadiene |
| | | Chemical intermediate surface-active agents |
| | | Comonomer for starch/acrylonitrile copolymers |
| | Agricultural Chemicals | Fumigant for mills and commodities (former use) |
| | | Synthetic soil blocks |
| | | Chemical intermediate for acrylamidoaminoethane sulfonic acid |
| | Plastics | Elastomers for hoses, gaskets & protective clothing |
| | | Chemical intermediate for fatty aminopropylamine & derivs. |
| | | Modifier for natural polymers |
| | | Comonomer for nitrile elastomers |
| | Water Treatment | In flocculants for water and waste treatment |
| | | Comonomer for alkyd/acrylonitrile copolymers |
| | | Organic synthesis to introd. cyanoethyl group |
| | | Comonomer with styrene for urethane polyether polyols |
| | | Chemical intermediate for adiponitrile & acrylamide |
| | Agricultural Chemicals | Fumigating stored tobacco |
| | Plastics | In plastics for appliances,automobile interior,boats,RV bodies,etc. |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U009 (continued) | Paper Manufacturing | Retention aids in papermaking & flotation processes |
| | | Comonomer for barrier resins |
| | Petroleum | Mobility control agents in crude oil recovery |
| | | Comonomer for acrylic acid |
| | Adhesive and Sealants | No information available |
| | Bottling | Bottles for soft drinks (use discontinued) |
| | Dyes and Pigments | Chemical intermediate dyes |
| | Fiber Manufacturing | To improve the dye and working properties of acrylic fibers |
| | Fiber Manufacturing | Comonomer for acrylic and modacrylic fibers |
| | Food Processing | Applied to milling,baking,food processing machinery |
| | Pesticide Manufacturing | In insecticides |
| | Pesticides | Pesticide fumigant for stored grain (former use) |
| | Pharmaceuticals | Chemical intermediate pharmaceuticals |
| | Pharmaceuticals | Chemical intermediate for glutethimide (sedative) |
| | Plastics and Resins | No information available |
| | Rubber | Manufacturing nitrile rubbers |
| | Textiles | Cyanoethylation of cotton |
| | Textile/Fiber Manufacturing | Manufacture of blankets,draperies,upholstery,syn. furs,wigs |
| | Textile/Fiber Manufacturing | In apparel,carpeting,home furnishing,sandbags,filter cloths,etc. |
| U149 Malonitrile | | Photosensitizer |
| | Medicine | Formerly used to treat mental illness |
| | | Acrylic fiber and dyestuff synthesis |
| | | Organic synthesis |
| | Lubricant | Lubricating oil additive |
| | | Leaching agent for gold |
| | Medicine | Thiamine synthesis |
| | Medicine | Anti-cancer agent synthesis |
| U152 Methacrylonitrile | | Preparation of homopolymers & copolymers |
| | | Intermediate in preparation of acids, amides, amines, esters, nitriles |
| | | Monomer for copolymers |
| | | Monomer for polymethacrylonitrile |
| | Plastics and Resins | Manufacture of elastomers, coatings, plastics |
| ORGANO-NITROGEN COMPOUND WASTES - GROUP 5 (NITRO COMPOUNDS) | | |
| P077 4-Nitroaniline | Automobile Manufacturing | Corrosion inhibitor |
| | Petroleum | Chemical intermediate for gasoline gum inhibitors |
| | | Chemical intermediate for P-Phenylenediamine |
| | Dyes and Pigments | Chemical intermediate for dyes and pigments |
| | Specialty Chemical | Chemical intermediate for antioxidants |
| | Pharmaceuticals | No information available |
| | Veterinary Medicine | For poultry |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U105 2,4-Dinitrotoluene | Dyes and Pigments | Chemical intermediate for dyes |
| | | Production of toluenediamine (Ramey nickel slurry process) |
| | | Chemical intermediate in production of toluene diisocyanate |
| | Explosives | Added to sensitizing materials in dynamite |
| | Explosives | Plasticizer in moderate and high explosives |
| | Explosives | Gelatinizing & waterproofing agent |
| | Explosives | Explosives intermediate |
| | Munition | Modifier for smokeless powders |
| | Plastics and Resins | Plastics manufacture |
| | Rubber | Rubber chemical |
| U106 2,6-Dinitrotoluene | | Chemical intermediate for toluene-2,2-diamine |
| | | Synthesis of urethane polymers, flexible & rigid foams |
| | Dyes and Pigments | In dyes |
| | Explosives | In synthesis of TNT |
| | Explosives | Gelatinizing and waterproofing agent in explosives |
| | Plastics and Resins | Surface coatings |
| U169 Nitrobenzene | | Solvent |
| | Jewelry | Ingredient of metal polishes |
| | | Manufacture pyroxylin compound |
| | Plastics and Resins | Preservative in spray paints |
| | | Solvent for cellulose ethers |
| | | Chemical intermediate for aniline, dichloroanilines |
| | | Refining lubricating oils |
| | | In soaps, shoe polishes |
| | Food | Substitute for almond essence |
| | | Production of isocyanates |
| | | Modifying esterification of cellulose acetate |
| | | Constituent of floor polishes |
| | Pesticides | Production of pesticides |
| | Pharmaceuticals | Production of pharmaceuticals (acetominophen) |
| | Rubber | Production of rubber chemicals |
| U171 2-Nitropropane | Paint and Varnish | Paint and varnish removal |
| | | Chemical intermediate for 2-Amino-2-methyl-1-propanol |
| | | Increase wetting ability & electrostatic spraying properties |
| | | Solvent for chemical reactions |
| | | Provide better flow characteristics & film integrety |
| | | Chemical synthesis |
| | Dyes and Pigments | Insure greater pigment dispersion |
| | | Co-solvent for coatings, ink, & adhesives |
| | | Insure more complete solvent release |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U171 (continued) | Munitions | Rocket propellant |
| | | Improve drying time in solvent systems |
| | | Processing solvent for extractions and separations |
| | Coating | Acid-proof lacquer on battery cases |
| | Coating | Solvent systems |
| | Dyes and Pigments | Intermediate in synthesis of dyes |
| | Pesticides | Intermediate in synthesis of insecticides |
| | Petroleum Refining | Racing car fuel |
| | Petroleum Refining | Gasoline additive |
| | Petroleum Refining | Smoke depressant in diesel fuel |
| | Pharmaceuticals | Intermediate in synthesis of pharmaceuticals |
| U181 5-Nitro-o-toluidine | Dyes and Pigments | Chemical intermediate for pigments and dyes |
| U234 sym-Trinitrobenzene | | Acid-base indicator for 12.0-14.0 pH |
| | Explosives | Explosive |
| | Rubber | Vulcanize natural rubber |
| ORGANO-NITROGEN COMPOUND WASTES - GROUP 6 (NITROSO COMPOUNDS) | | |
| P082 N-Nitrosodimethylamine | Lubricant Manufacturing | In lubricants |
| | | Research chemical |
| | Specialty Chemical | Preparation of thiocarbonyl fluoride polymers |
| | Specialty Chemical | Chemical intermediate for 1,1-Dimethylhydrazine (former use) |
| | | Antioxidant |
| | Petroleum refining | Production of rocket fuels (former use) |
| | | Condensers to increase dielectric constant |
| | | Inactive metal anode-electrolyte systems (high-energy batteries) |
| | Plastics | Plasticizer for acrylonitrile polymers |
| | Plastics, Fibers | Solvent in fiber and plastics |
| | | Industrial solvent |
| | Plastics | Softener for copolymers |
| | Agricultural Chemicals | Inhibition of nitrification in soil |
| | Pesticides | As nematocide |
| | Rubber | Plasticization of rubber |
| | Rubber | Rubber accelerator |
| P084 N-Nitrosomethylvinylamine | | Research chemical |
| U111 Di-n-propylnitrosamine | | Research chemical |
| U172 N-Nitroso-di-n-butylamine | | Research chemical |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

TABLE 2-1 (Continued)

INDUSTRIAL USE OF MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| WASTE CODE | INDUSTRY | USE(a) |
|---|---|---|
| U173 N-Nitroso-diethanolamine | | Researh chemical |
| U174 N-Nitrosodiethylamine | | Research chemical<br>Stabilizer<br>Antioxidant |
| | Petroleum Refining | Gasoline and lubricant additive |
| U176 N-Nitroso-N-ethylurea | | Research chemical<br>Laboratory preparation of diazoethane |
| U177 N-Nitroso-N-methylurea | | Mutagenic effects on various plants<br>Laboratory synthesis of diazomethane |
| U178 N-Nitroso-N-methylurethane | | Laboratory synthesis of diazomethane<br>Research chemical |

a Source : National Library of Medicine, Hazardous Substances Databank (Reference 4).

Table 2-2

## NUMBER OF FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| Waste Code | Number of Facilities* | Waste Code | Number of Facilities* |
|---|---|---|---|
| MISCELLANEOUS HALOGENATED ORGANIC WASTES: | | WASTES OF A PHARMACEUTICAL NATURE: | |
| P016 | 4 | P018 | 3 |
| P023 | 5 | P042 | 5 |
| P024 | 6 | P075 | 3 |
| P026 | 1 | P108 | 6 |
| P027 | 2 | U010 | 4 |
| P028 | 20 | U089 | 3 |
| P057 | 1 | U141 | 2 |
| P095 | 23 | U155 | 3 |
| U006 | 13 | U163 | 6 |
| U017 | 2 | U164 | 4 |
| U024 | 1 | U187 | 5 |
| U025 | 2 | U200 | 7 |
| U026 | 1 | U202 | 3 |
| U027 | 1 | U203 | 6 |
| U033 | 8 | U206 | 3 |
| U034 | 6 | | |
| U041 | 2 | | |
| U042 | 1 | BROMINATED ORGANIC WASTES: | |
| U043 | 14 | | |
| U045 | 13 | | |
| U046 | 3 | P017 | 4 |
| U047 | 2 | U029 | 3 |
| U073 | 4 | U030 | 1 |
| U075 | 19 | U067 | 9 |
| U121 | 12 | U068 | 9 |
| U138 | 19 | U225 | 6 |
| U156 | 2 | | |
| U158 | 8 | | |
| U192 | 1 | | |
| U222 | 1 | | |

* Sources: U.S. EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 and 7)
National Library of Medicine, Toxicology Data Network,
Hazardous Substances Databank (HSDB) (Reference 4)

## Table 2-2 (continued)

## NUMBER OF FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC, WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES, AND ORGANO-NITROGEN COMPOUND WASTES

| Waste Code | Number of Facilities* |
|---|---|
| ORGANO-SULFUR COMPOUND WASTES: | |
| P002 | 1 |
| P014 | 6 |
| P022 | 14 |
| P042 | 5 |
| P066 | 6 |
| P070 | 5 |
| P072 | 1 |
| P093 | 1 |
| P116 | 8 |
| P118 | 2 |
| U020 | 9 |
| ORGANO-NITROGEN COMPOUND WASTES: | |
| P008 | 5 |
| P046 | 1 |
| P054 | 2 |
| P064 | 4 |
| P067 | 3 |
| P069 | 2 |
| P077 | 9 |
| P082 | 1 |
| P084 | 1 |
| P101 | 7 |
| U003 | 22 |
| U007 | 19 |
| U009 | 22 |
| ORGANO-NITROGEN COMPOUND WASTES (continued): | |
| U011 | 6 |
| U012 | 27 |
| U014 | 4 |
| U021 | 5 |
| U091 | 2 |
| U092 | 11 |
| U095 | 2 |
| U105 | 11 |
| U106 | 4 |
| U110 | 7 |
| U148 | 10 |
| U149 | 1 |
| U152 | 4 |
| U167 | 17 |
| U168 | 2 |
| U169 | 17 |
| U171 | 4 |
| U174 | 3 |
| U177 | 1 |
| U181 | 1 |
| U191 | 11 |
| U194 | 8 |
| U196 | 6 |
| U221 | 9 |
| U223 | 38 |
| U234 | 1 |
| U236 | 2 |
| U238 | 4 |

* Sources: U.S. EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 and 7)
National Library of Medicine, Toxicology Data Network,
Hazardous Substances Databank (HSDB) (Reference 4)

Table 2-3

### FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| Alabama | IV | P095(1) | P042(1) | | P014(1)<br>P022(1)<br>U020(1)<br>U244(1) | P101(1) |
| Arizona | VI | | | | U219(1) | U223(1) |
| Arkansas | IX | | | U029(2)<br>U067(3) | | |
| California | IX | U033(1)<br>U075(3)<br>U121(3)<br>U138(1) | P042(1)<br>P108(1) | U067(1)<br>U225(1) | U218(1) | P064(1)<br>U223(1) |
| Colorado | VIII | | | | P066(1) | |
| Connecticut | I | U006(1)<br>U073(1)<br>U075(1)<br>U138(1)<br>U158(1) | U163(1) | | P022(1)<br>P116(1)<br>U219(1)<br>U244(3) | U007(1)<br>U091(1)<br>U092(1)<br>U148(1)<br>U223(3) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

Table 2-3 (Continued)

FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| Delaware | III | P028(1)<br>P095(1)<br>U006(2)<br>U138(1) | P108(1)<br>U089(2)<br>U163(1)<br>U202(1) | | P014(1)<br>P022(1)<br>P066(1)<br>P070(1)<br>U020(1)<br>U114(1)<br>U116(1)<br>U218(1) | P077(1)<br>P101(1)<br>U007(1)<br>U009(1)<br>U011(1)<br>U012(1)<br>U092(1)<br>U105(1)<br>U148(1)<br>U152(1)<br>U167(1)<br>U169(1)<br>U194(1)<br>U223(1) |
| Florida | IV | P016(1)<br>U075(1)<br>U158(1) | | | | U092(1)<br>U110(1)<br>U194(1)<br>U223(2) |
| Georgia | IV | U033(1) | | | P070(1)<br>U114(10 | |
| Illinois | V | U033(1)<br>U045(1)<br>U075(1)<br>U121(2)<br>U158(1) | P042(1)<br>U155(1)<br>U206(1) | U225(1) | U219(1) | P077(2)<br>U003(3)<br>U009(3)<br>U011(1)<br>U012(1)<br>U148(1)<br>U169(1)<br>U171(1)<br>U174(1)<br>U191(1)<br>U223(1)<br>U234(1) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

### Table 2-3 (Continued)

### FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| Indiana | V | P095(1) | | P017(1) | | P008(1)<br>U092(2)<br>U171(1)<br>U191(1)<br>U196(1) |
| Kansas | VII | U138(1) | | | | |
| Kentucky | IV | U043(1)<br>U045(1)<br>U075(1) | | | | U009(1)<br>U092(1)<br>U221(1) |
| Louisiana | VI | P024(2)<br>P095(3)<br>U043(6)<br>U045(2)<br>U121(1) | U200(1) | | P022(1) | U007(2)<br>U009(2)<br>U012(2)<br>U015(2)<br>U016(1)<br>U148(5)<br>U169(1)<br>U194(1)<br>U221(2)<br>U223(3) |
| Maryland | III | P095(1)<br>U042(1)<br>U156(1) | | | | U223(2) |
| Massachusetts | I | P023(2) | | | U193(1) | U003(2)<br>U007(1)<br>U009(1)<br>U110(1)<br>U194(1)<br>U238(1) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

Table 2-3 (Continued)

FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| Michigan | V | P095(1)<br>U045(1)<br>U073(1)<br>U075(1)<br>U121(1) | U206(1) | U068(1)<br>U225(1) | U219(1) | P064(1)<br>U007(1)<br>U110(1) |
| Minnesota | V | | | | | P067(1)<br>P077(1) |
| Mississippi | IV | | | | P022(1)<br>U114(1) | U012(2)<br>U169(1)<br>U223(1) |
| Missouri | VII | U003(1)<br>U006(1)<br>U075(1)<br>U158(1) | P108(1)<br>U155(1)<br>U187(1)<br>U200(1) | U167(1)<br>U225(1) | P066(1)<br>P070(1) | P101(1)<br>U007(2)<br>U011(1)<br>U012(1)<br>U091(1)<br>U169(1) |
| Nevada | IX | U034(1) | | | P014(1) | |
| New Jersey | II | P023(1)<br>P024(2)<br>P028(6)<br>P057(1)<br>P095(1)<br>U006(5)<br>U017(1)<br>U033(1)<br>U045(1)<br>U075(4)<br>U121(2) | P018(1)<br>U163(1)<br>U187(1)<br>U200(2)<br>U203(4) | P017(2)<br>U067(1)<br>U068(4) | P022(1)<br>P072(1)<br>P116(3)<br>U218(4)<br>U219(2)<br>U244(1) | P067(2)<br>P077(1)<br>U007(3)<br>U009(1)<br>U011(1)<br>U012(3)<br>U014(3)<br>U092(1)<br>U105(1)<br>U110(1)<br>U148(2) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

Table 2-3 (Continued)

## FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| New Jersey (continued) | II | U138(6)<br>U141(1)<br>U222(1) | | | | U167(1)<br>U169(2)<br>U181(1)<br>U191(2)<br>U194(1)<br>U196(2)<br>U223(1)<br>U236(2)<br>U238(1) |
| New Mexico | VI | P095(1) | | U225(1) | | U223(1) |
| New York | II | P016(1)<br>P023(1)<br>P027(1)<br>P028(1)<br>P095(1)<br>U045(2)<br>U046(1)<br>U047(1)<br>U138(4) | P075(1)<br>P108(2)<br>U010(2)<br>U163(1)<br>U187(2)<br>U200(1)<br>U202(1) | P017(1)<br>U067(1)<br>U068(2) | P022(1)<br>P093(1)<br>P116(2)<br>U020(2)<br>U114(1)<br>U219(3) | P008(1)<br>P101(1)<br>U003(3)<br>U007(3)<br>U009(1)<br>U012(1)<br>U021(2)<br>U095(1)<br>U105(1)<br>U169(3)<br>U191(3)<br>U196(2)<br>U221(1)<br>U223(8) |
| North Carolina | IV | P028(1)<br>U006(1)<br>U034(1)<br>U043(1)<br>U158(1) | U010(1)<br>U089(1)<br>U141(1)<br>U163(1)<br>U200(1)<br>U203(1) | U067(1)<br>U068(1) | P014(1)<br>P022(1)<br>U119(1) | P008(1)<br>P101(1)<br>U003(2)<br>U007(1)<br>U009(1)<br>U011(1)<br>U012(2)<br>U014(1) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

Table 2-3 (Continued)

## FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| North Carolina (continued) | IV | | | | | U021(1)<br>U092(1)<br>U110(1)<br>U148(1)<br>U168(1)<br>U169(1)<br>U174(1)<br>U177(1)<br>U221(1)<br>U238(1) |
| Ohio | V | P095(2)<br>U033(1)<br>U034(1)<br>U138(1) | U202(1) | | P118(1) | P077(1)<br>U003(1)<br>U007(1)<br>U009(2)<br>U012(6)<br>U021(1)<br>U095(1)<br>U194(1)<br>U221(1)<br>U223(3) |
| Pennsylvania | III | P024(1)<br>P028(3)<br>U006(1)<br>U024(1)<br>U045(1)<br>U046(1)<br>U075(3)<br>U121(2)<br>U192(1) | | U067(1) | U020(1)<br>U114(1)<br>U219(2)<br>U244(1) | P077(1)<br>U009(1)<br>U011(1)<br>U105(1)<br>U152(1)<br>U191(1)<br>U196(1) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

## Table 2-3 (Continued)

## FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| Puerto Rico | II | | | | | U003(2)<br>U169(1)<br>U191(1) |
| Rhode Island | I | U138(1) | | | | |
| South Carolina | IV | U017(1)<br>U075(1)<br>U121(1)<br>U138(1) | | | U219(1) | P008(1) |
| Tennessee | IV | P028(1) | P075(1) | | P022(1)<br>U020(1) | P069(1)<br>U003(1)<br>U012(1) |
| Texas | VI | P095(5)<br>U006(1)<br>U025(1)<br>U026(1)<br>U027(1)<br>U033(1)<br>U034(2)<br>U041(2)<br>U043(5)<br>U045(1)<br>U073(1)<br>U138(1)<br>U156(1) | | | P014(1)<br>P022(1)<br>P066(2)<br>P116(1)<br>P118(1)<br>U020(1)<br>U114(1)<br>U153(3) | P069(1)<br>P101(1)<br>U003(4)<br>U007(1)<br>U009(4)<br>U012(3)<br>U092(1)<br>U105(2)<br>U106(1)<br>U152(1)<br>U169(1)<br>U171(1)<br>U194(1)<br>U221(2)<br>U223(5) |
| Utah | VIII | | | | | P054(1) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

Table 2-3 (Continued)

FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| Virginia | III | U158(1) | P018(1) | | U020(1)<br>U219(1) | P077(1)<br>U007(1)<br>U110(1)<br>U167(1)<br>U194(1)<br>U223(2) |
| Washington | X | P016(1)<br>P028(1)<br>U043(1)<br>U075(1)<br>U158(2) | P042(2) | | P002(1)<br>P022(1)<br>U219(1) | U169(1) |
| West Virginia | III | U045(2) | | | P022(1)<br>P045(1)<br>P066(1)<br>P070(2)<br>U116(2)<br>U244(1) | P064(2)<br>U003(1)<br>U009(2)<br>U012(2)<br>U092(1)<br>U105(2)<br>U106(2)<br>U148(1)<br>U169(2)<br>U191(2)<br>U223(3) |
| Wisconsin | V | P016(1)<br>P023(1)<br>P024(1)<br>P026(1)<br>P027(1)<br>P095(1)<br>U006(1)<br>U034(1)<br>U045(1) | P018(1)<br>P075(1)<br>P108(1)<br>U010(1)<br>U089(1)<br>U155(1)<br>U163(1)<br>U187(1)<br>U200(1) | P017(1)<br>U029(1)<br>U030(1)<br>U067(1)<br>U068(1)<br>U225(1) | P014(3)<br>P022(1)<br>P116(1)<br>U020(1)<br>U116(1)<br>U119(1)<br>U153(1)<br>U193(1)<br>U218(1) | P008(1)<br>P046(1)<br>P054(1)<br>P077(1)<br>P082(1)<br>P084(1)<br>P101(1)<br>U003(1)<br>U007(1) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

## Table 2-3 (Continued)

## FACILITIES THAT MAY GENERATE MISCELLANEOUS HALOGENATED ORGANIC WASTES, WASTES OF A PHARMACEUTICAL NATURE, BROMINATED ORGANIC WASTES, ORGANO-SULFUR COMPOUND WASTES AND ORGANO-NITROGEN COMPOUND WASTES

| | | Wastes Potentially Generated (Number of Facilities)* | | | | |
|---|---|---|---|---|---|---|
| State | EPA Region | Halogenated Organic Wastes | Wastes of a Phamaceutical Nature | Brominated Organic Wastes | Organo-sulfur Compound Wastes | Organo-Nitrogen Compounds Wastes |
| Wisconsin (continued) | | U046(1)<br>U047(1)<br>U073(1)<br>U138(1) | U203(1)<br>U206(1) | | U219(1) | U009(2)<br>U012(1)<br>U021(1)<br>U092(1)<br>U105(1)<br>U110(1)<br>U149(1)<br>U152(1)<br>U168(1)<br>U169(1)<br>U171(1)<br>U174(1)<br>U221(1)<br>U238(1) |

* Sources: U.S.EPA 1986 TSDR Survey (Reference 5)
1987, 1988 SRI Directory of Chemical Producers, USA (References 6 & 7)
National Library of Medicine, Toxicology Data Network, Hazardous Substances Databank (HSDB) (Reference 4)

## Table 2-4

## WASTE TREATABILITY GROUPS

| Waste Code | Constituent | Amenable to Quantification by Current Analytical Methods? (Y or N) |
|---|---|---|
| | **MISCELLANEOUS HALOGENATED ORGANIC WASTES** | |
| | **Chlorinated Diphenyls** | |
| U073 | 3,3'-Dichlorobenzidine | Y |
| U158 | 4,4-Methylene-bis-(2-chloroaniline) | Y |
| | **Chlorinated Polynuclear Aromatics** | |
| U047 | 2-Chloronaphthalene | Y |
| U026 | Chloronaphazine | N |
| | **Chlorinated Amines, Amides, and Nitriles** | |
| P024 | p-Chloroaniline | Y |
| U192 | Pronamide | Y |
| P057 | 2-Fluoroacetamide | N |
| U049 | 4-Chloro-o-toluidine hydrochloride | N |
| U097 | Dimethyl carbonyl chloride | N |
| U222 | o-Toluidine hydrochloride | N |
| | **Chlorinated Methylbenzenes** | |
| U017 | Benzal chloride | Y * |
| P028 | Benzyl chloride | N |
| | **Halogenated Aliphatics** | |
| U043 | Vinyl chloride | Y |
| U045 | Chloromethane | Y |
| U075 | Dichlorodifluoromethane | Y |
| U121 | Fluorotrichloromethane | Y |
| U138 | Iodomethane | Y |
| P027 | 3-Chloroproprionitrile | N |

## Table 2-4 (Continued)

## WASTE TREATABILITY GROUPS

### MISCELLANEOUS HALOGENATED ORGANIC WASTES (Continued)

#### Halogenated Aldehydes, Ethers, and Esters

| Waste Code | Constituent | Amenable to Quantification by Current Analytical Methods? (Y or N) |
|---|---|---|
| U024 | Bis-(2-chloroethoxy)methane | Y |
| U025 | Dichloroethyl ether | Y |
| U027 | Bis-(2-chloroisopropyl)ether | Y |
| U042 | 2-Chloroethyl vinyl ether | Y ** |
| U034 | Trichloroacetaldehyde | N |
| U156 | Methyl chlorocarbonate | N |
| P016 | Bis-(chloromethyl)ether | N |
| P023 | Chloroacetaldehyde | N |
| P058 | Fluoroacetic acid | N |
| P095 | Phosgene | N |
| U006 | Acetyl chloride | N |
| U033 | Carbonyl fluoride | N |
| U041 | n-Chloro-2,3-epoxypropane | N |
| U046 | Chloromethyl methyl ether | N |

#### Halogenated Organosulfur Compounds

| Waste Code | Constituent | Amenable to Quantification by Current Analytical Methods? (Y or N) |
|---|---|---|
| P026 | 1-(o-Chlorophenyl)thiourea | N |
| P118 | Trichloromethanethiol | N |
| U020 | Benzenesulfonyl chloride | N |
| U062 | Diallate | N |

### WASTES OF A PHARMACEUTICAL NATURE

| Waste Code | Constituent | Amenable to Quantification by Current Analytical Methods? (Y or N) |
|---|---|---|
| U141 | Isosafrole | Y |
| U155 | Methapyrilene | Y |
| U187 | Phenacetin | Y |
| U203 | Safrole | Y |
| P007 | 5-Aminoethyl-3-isoxazolol | N |
| P042 | Epinephrine | N |
| P075 | Nicotine and salts | N |
| P108 | Strychnine and salts | N |
| U010 | Mitomycin C | N |
| U015 | Azaserine | N |
| U035 | Chlorambucil | N |
| U059 | Daunomucin | N |
| U089 | Diethylstilbestrol | N |
| U090 | Dihydrosafrole | N |
| U143 | Lasiocarpine | N |

Table 2-4 (Continued)

WASTE TREATABILITY GROUPS

| Waste Code | Constituent | Amenable to Quantification by Current Analytical Methods? (Y or N) |
|---|---|---|
| | **WASTES OF A PHARMACEUTICAL NATURE (continued)** | |
| U150 | Melphalan | N |
| U163 | N-Methyl,N-nitro-,N-nitroguanidine | N |
| U164 | Methylthiouracil | N |
| U200 | Reserpine | N |
| U202 | Saccharin and salts | N |
| U206 | Streptozatocin | N |
| U237 | Uracil mustard | N |
| | **BROMINATED ORGANIC WASTES** | |
| U029 | Methyl bromide (Bromomethane) | Y |
| U030 | 4-Bromophenyl phenyl ether | Y |
| U066 | 1,2-Dibromo-3-chloropropane | Y |
| U067 | Ethylene dibromide (1,2-Dibromomethane) | Y |
| U068 | Dibromomethane | Y |
| U225 | Bromoform (Tribromomethane) | Y |
| P017 | Bromoacetone | N |
| | **ORGANO-SULFUR COMPOUND WASTES** | |
| P014 | Thiophenol (Benzenethiol) | Y ** |
| P022 | Carbon disulfide | Y ** |
| P002 | 1-Acetyl, 2-thiourea | N |
| P045 | Thiofanox | N |
| P049 | 2,4-Dithiobiuret | N |
| P066 | Methomyl | N |
| P070 | Aldicarb | N |
| P072 | 1-Haphthyl-2-thiourea | N |
| P093 | N-Phenylthiourea | N |
| P116 | Thiosemicarbazide | N |
| U114 | Ethylene bis-dithiocarbamic acid | N |
| U116 | Ethylene thiourea | N |
| U119 | Ethyl methane sulfonate | N |
| U153 | Methanethiol | N |
| U193 | 1,3-Propane sulfone | N |
| U218 | Thioacetamide | N |
| U219 | Thiourea | N |
| U244 | Thiram | N |

## Table 2-4 (Continued)

## WASTE TREATABILITY GROUPS

| Waste Code | Constituent | Amenable to Quantification by Current Analytical Methods? (Y or N) |
|---|---|---|
| | **ORGANO-NITROGEN COMPOUND WASTES (continued)** | |
| | **Nitrogen Heterocyclics** | |
| U179 | N-Nitrosopiperidine | Y |
| U180 | N-Nitrosopyrrolidine | Y |
| U196 | Pyridine | Y |
| P008 | 4-Aminopyridine | N |
| P018 | Brucine | N |
| P054 | Aziridine | N |
| P067 | 2-Methylaziridine | N |
| U011 | Amitrole | N |
| U148 | Maleic anhydride | N |
| U191 | 2-Picoline | N |
| | **Amines and Amides** | |
| U007 | Acrylamide | Y ** |
| U012 | Aniline | Y |
| U167 | 1-Naphthylamine | Y |
| U168 | 2-Naphthylamine | Y |
| P046 | alpha, alpha-Dimethylphenethylamine | N |
| P064 | Isocyanic acid, methyl ester | N |
| U092 | Dimethylamine | N |
| U110 | Dipropylamine | N |
| U194 | n-Propylamine | N |
| U238 | Ethyl carbamate | N |
| | **Aminated Diphenyls and Biphenyls** | |
| U091 | 3,3'-Dimethoxybenzidine | Y ** |
| U093 | p-Dimethylaminoazobenzene | Y |
| U095 | 3,3'-Dimethylbenzidine | Y ** |
| U014 | Auramine | N |
| U021 | Benzidine | N |
| U236 | Trypan blue | N |
| | **Nitriles** | |
| P101 | Ethyl cyanide (Propanenitrile) | Y |
| U003 | Acetonitrile | Y |
| U009 | Acrylonitrile | Y |
| U152 | Methacrylonitrile | Y |
| P069 | Methyllactonitrile | N |
| U149 | Malonitrile | N |

## Table 2-4 (Continued)

## WASTE TREATABILITY GROUPS

| Waste Code | Constituent | Amenable to Quantification by Current Analytical Methods? (Y or N) |
|---|---|---|
| | **ORGANO-NITROGEN COMPOUND WASTES** | |
| | **Nitro Compounds** | |
| P077 | p-Nitroaniline | Y |
| U105 | 2,4-Dinitrotoluene | Y |
| U106 | 2,6-Dinitrotoluene | Y |
| U169 | Nitrobenzene | Y |
| U181 | 5-Nitro-o-toluidine | Y |
| U234 | sym-Trinitrobenzene | N |
| U171 | 2-Nitropropane | N |
| | **Nitroso Compounds** | |
| P082 | N-Nitrosodimethylamine | Y |
| U111 | Di-n-propylnitrosamine | Y |
| U172 | N-Nitroso-di-n-butylamine | Y |
| U174 | N-Nitrosodiethylamine | Y |
| P084 | N-Nitrosomethylvinylamine | N |
| U173 | N-Nitroso-diethanolamine | N |
| U176 | N-Nitroso-N-ethylurea | N |
| U177 | N-Nitroso-N-methylurea | N |
| U178 | N-Nitroso-N-methylurethane | N |

* The Agency is soliciting comment on the reproducability of analysis of benzal chloride in treatment residuals. Therefore, the Agency is proposing both numerical treatment standards and specifying a method of treatment as the BDAT treatment standard as regulatory options for U017.

** Although this waste constituent is amenable to quantification in hazardous waste matrices, the Agency was unable to develop numerical treatment standards for this constituent as discussed in Section 6.0. Therefore, the Agency is specifying a method of treatment as the BDAT treatment standard for this waste code.

## 3.0 IDENTIFICATION OF BEST DEMONSTRATED AND AVAILABLE TECHNOLOGY (BDAT)

This section presents the Agency's rationale for determining the best demonstrated available technology (BDAT) for miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, brominated organic wastes, organo-sulfur compound wastes, and organo-nitrogen compound wastes. As complex heterosubstituted organic compounds, the Agency believes that all of the waste codes included in the five treatability groups can be effectively treated by the same treatment technologies. BDAT has been identified to be incineration for nonwastewater forms of these wastes and incineration for wastewater forms of these wastes which are amenable to quantification in hazardous waste matrices. BDAT for wastewater forms of these wastes that cannot be quantified in hazardous waste matrices using current analytical methods is wet air oxidation followed by carbon adsorption, chemical oxidation followed by carbon adsorption, and incineration. In addition, biological treatment followed by carbon adsorption is BDAT for wastewater forms of these wastes (except those included in the miscellaneous halogenated organic treatability group) that are not amenable to quantification in hazardous waste matrices using current analytical methods.

Alternate concentration-based treatment standards for all U and P wastewaters have also been developed based on additional wastewater treatment data from several technologies. These data and the corresponding treatment technologies are discussed in Reference 9 and are included in Sections III.A.2.a.(3.) and III.A.1.h.(b.) of the preamble.

This section presents the Agency's determination of:

- applicable technologies;
- demonstrated technologies;
- available technologies; and
- the best technology for treatment of these wastes.

In determining BDAT, the Agency first determines which technologies are potentially applicable for treatment of the waste(s) of interest. The Agency then determines which of the applicable technologies are demonstrated for treatment of the waste(s) of interest, and of those demonstrated technologies, which are considered to be available for treatment of the waste(s) of interest.

All of the commercial chemical products included in this document are organic. Therefore, the treatment technologies identified in this section are for treatment of hazardous organic constituents. Some of the wastes may contain metals at treatable concentrations as a result of the manner in which the waste was generated; however, the Agency is not identifying applicable, demonstrated, and available technologies for treatment of metals in these U and P wastes at this time because these wastes are defined as organic chemicals.

## 3.1 Applicable Treatment Technologies

To be applicable, a technology must theoretically be usable to treat the waste in question or to treat a waste that is similar in terms of parameters that affect treatment selection. (Detailed descriptions of technologies that are applicable to treat listed hazardous wastes are provided in EPA's Treatment Technologies Background Document (Reference 8)).

The following subsections present applicable treatment technologies for nonwastewater and wastewater forms of the miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, brominated organic wastes, organo-sulfur compound wastes, and organo-nitrogen compound wastes.

### 3.1.1 Nonwastewaters

Since nonwastewater forms of these wastes may contain hazardous organic constituents at treatable concentrations as discussed in Section 2.2, applicable treatment technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following treatment technologies as applicable for these wastes:

- incineration (fluidized bed, rotary kiln, and liquid injection);
- solvent extraction followed by incineration or recycle of the extract;
- critical fluid extraction followed by incineration of the contaminated solvents; and
- wet air oxidation.

Total recycle or reuse may also be applicable for certain wastes such as off-specification commercial chemical products. These treatment technologies were identified based on current waste treatment practices and engineering judgment.

Many of the U and P wastes addressed in this background document may be generated in a variety of forms, and application of treatment technologies depends upon the physical form of the waste. For example, a contaminated soil may be amenable to rotary kiln incineration, while an off-specification liquid chemical product may be amenable to liquid injection incineration.

#### 3.1.1.1 Incineration

Incineration is a destruction technology in which energy, as heat, is transferred to the waste to destabilize chemical bonds and destroy hazardous organic constituents. In a fluidized bed incinerator, waste is injected into the fluidized bed material (generally sand and/or incinerator ash), where it is heated to its ignition temperature. Heat energy from the combustion reactions is then transferred back to the fluidized bed. Ash is removed periodically during operation and during bed change-outs.

In a rotary kiln incinerator, wastes are fed into the elevated end of the kiln, and the rotation of the kiln mixes the waste with hot gases to heat the waste to its ignition temperature. Ash is removed from the lower end of the kiln. Combustion gases from the kiln enter the afterburner for complete destruction of organic waste constituents. Other wastes may also be injected into the afterburner.

In a liquid injection incinerator, liquid wastes are atomized and injected into the incinerator. In general, only wastes with low or negligible ash content are amenable to liquid injection incineration. Therefore, this technology generally does not generate an ash residual.

Combustion gases from the incinerator are then fed to a scrubber system for cooling and removal of entrained particulates and acid gases, if present. In general, with the exception of liquid injection incineration, two residuals are generated by incineration processes: ash and scrubber water.

### 3.1.1.2 Solvent Extraction

Solvent extraction is a separation technology in which organics are removed from the waste due to greater constituent solubility in the solvent phase than in the waste phase. This technology generates two residuals: a treated waste residual and an extract. The extract may be recycled or treated by incineration.

### 3.1.1.3 Critical Fluid Extraction

Critical fluid extraction is a solvent extraction technology in which the solvent is brought to its critical state (liquid gas) to aid in the extraction of hazardous organic constituents from the wastes. After the extraction step, the solvent is returned to its normal gaseous state, generating a small volume of extract that is concentrated in hazardous organic constituents. This technology generates two residuals: a treated waste residual and an extract. The extract may be recycled or treated by incineration.

### 3.1.1.4 Wet Air Oxidation

Wet air oxidation is a destruction technology in which hazardous organic constituents in wastes are oxidized and destroyed under pressure at elevated temperatures in the presence of dissolved oxygen. This technology is applicable for wastes comprised primarily of water and up to 10% total organic constituents. Wet air oxidation generates one treatment residual: treated effluent. The treated effluent may require further treatment for hazardous organic constituents by carbon adsorption or PACT$^R$ treatment (these technologies are described in Section 3.1.2). Emissions from wet air oxidation may require further treatment by incineration.

### 3.1.1.5 Total Recycle or Reuse

Total recycle or reuse of a waste in the same process or another process eliminates the generation of the waste and consequently generates no treatment residuals.

### 3.1.2 Wastewaters

Since wastewater forms of these wastes may contain hazardous organic constituents at treatable concentrations, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste. Therefore, the Agency has identified the following treatment technologies as potentially applicable for treatment of these wastes:

- incineration;
- wet air oxidation;
- $PACT^R$ treatment;
- biological treatment;
- carbon adsorption;
- solvent extraction; and
- chemical oxidation.

Total recycle or reuse may also be applicable for certain wastewaters. These treatment technologies were identified based on current waste treatment practices and engineering judgment.

The concentrations and type(s) of waste constituents present in the waste generally determine which technology is most applicable. Carbon adsorption, for example, is often used as a polishing step following primary treatment by biological treatment, solvent extraction, or wet air oxidation. Typically, carbon adsorption is applicable for treatment of wastewaters containing less than 0.1% total organic constituents. Wet air oxidation, $PACT^R$ treatment, biological treatment, and solvent extraction are applicable for treatment of wastewaters containing up to 1% total organic constituents. Many of the wastewaters that are the subject of this document may contain constituents that are too toxic to biomass and therefore cannot be treated effectively by biological treatment or $PACT^R$ treatment.

#### 3.1.2.1 Incineration

The description of incineration of nonwastewaters is described previously in Section 3.1.1. This description also applies to the incineration of wastewaters.

#### 3.1.2.2 Wet Air Oxidation

The description of wet air oxidation of nonwastewaters is described previously in Section 3.1.1. This description also applies to the wet air oxidation of wastewaters.

#### 3.1.2.3 PACT$^R$ Treatment

PACT$^R$ treatment is a combination of carbon adsorption and biological treatment in which hazardous organic constituents are biodegraded or selectively adsorbed onto powdered-activated carbon. This technology generates two treatment residuals: a treated effluent and spent carbon/biosludge. The spent carbon may be regenerated and recycled to the process or may be incinerated.

#### 3.1.2.4 Biological Treatment

Biological treatment is a destruction technology in which hazardous organic constituents in wastewaters are biodegraded. This technology generates two treatment residuals: a treated effluent and a waste biosludge. Waste biosludge may be land disposed without further treatment if it is less than or equal to the BDAT treatment standards. The Agency believes that halogenated organic wastes may not be amenable to biological treatment. However, the Agency is soliciting comments as to whether biological treatment is applicable for treatment of any of the halogenated organic wastes.

### 3.1.2.5 Carbon Adsorption

Carbon adsorption is a separation technology in which hazardous organic constituents in wastewaters are selectively adsorbed onto activated carbon. This technology generates two treatment residuals: a treated effluent and spent activated carbon. The spent activated carbon can be reactivated and recycled.

### 3.1.2.6 Solvent Extraction

The description of solvent extraction of nonwastewaters is described previously in Section 3.1.1. This description also applies to the solvent extraction of wastewaters.

### 3.1.2.7 Chemical Oxidation

Chemical oxidation is a destruction technology in which inorganic cyanides, some dissolved organic compounds, and sulfides are chemically oxidized to yield carbon dioxide, water, salts, simple organic acids, and, in the case of sulfides, sulfates. This technology generates one treatment residual: treated effluent.

### 3.1.2.8 Total Recycle or Reuse

The description of total recycle or reuse of nonwastewaters is described previously in Section 3.1.1. This description also applies to the total recycle or reuse of wastewaters.

## 3.2 Demonstrated Treatment Technologies

To be demonstrated, a technology must be employed in full-scale operation for treatment of the waste in question or a similar waste. Technologies available only at pilot- or bench-scale operations are not considered in identifying demonstrated technologies.

### 3.2.1 Nonwastewaters

The Agency has identified incineration as a demonstrated technology for treatment of nonwastewater forms of these wastes. For the land disposal restrictions program, the Agency tested rotary kiln incineration on a full-scale operational basis for the following waste constituents in each treatability group, as described in Section 4.0:

Miscellaneous Halogenated Organic Wastes

Chloromethane
Dichlorodifluoromethane
Vinyl chloride
Bis(2-chloroethyl)ether
3,3'-Dichlorobenzidine
Pronamide

Wastes of a Pharmaceutical Nature

Isosafrole

Brominated Organic Wastes

Ethylene dibromide

Organo-nitrogen Compound Wastes

Acetonitrile
Acrylonitrile
Aniline
Nitrobenzene
Pyridine

The Agency believes that since incineration is demonstrated for treatment of these waste constituents, incineration is also demonstrated for all of the wastes included in each treatability group based on similarities in chemical and physical properties as discussed in Section 2.3.

The Agency believes that incineration is also demonstrated for organo-sulfur compound wastes because they are similar in chemical structure to other aliphatic and aromatic wastes that have been successfully treated by incineration on a full-scale operational basis. However, the Agency is requesting comments on incineration as a demonstrated technology for organo-sulfur compound wastes and is soliciting supporting evidence on concentrations of sulfur in waste feeds that have been successfully incinerated.

The Agency is not aware of any facilities that treat nonwastewater forms of these wastes or wastes judged to be similar on a full-scale operational basis using solvent extraction, critical fluid extraction, or wet air oxidation; therefore, EPA believes that these technologies are not currently demonstrated for these wastes.

Although the Agency believes that recycling and reuse is applicable for off-specification U and P wastes, the Agency is not aware of any facilities that do so. Therefore, recycle and reuse is not considered to be demonstrated for these wastes at this time.

### 3.2.2 Wastewaters

Additional wastewater treatment performance data, primarily from the Agency's Office of Water, have been recently analyzed for the U and P wastes included in this document. These data are for treatment of wastewaters that are not specifically listed as U and P wastewaters, but contain many of the corresponding U or P waste constituents. While these data were not available in time for incorporation into this background document, these data are included in the Wastewater Background Document (Reference 3). The following technologies have been identified as demonstrated for treatment of waste constituents in each treatability group:

Miscellaneous Halogenated Organic Wastes

Biological Treatment
Biological Treatment followed by Filtration
Steam Stripping

Air Stripping
Carbon Adsorption
Solvent Extraction followed by Steam Stripping followed by Carbon Adsorption
Chemically Assisted Clarification
Chemical Oxidation
Wet Air Oxidation

### Wastes of a Pharmaceutical Nature

Wet Air Oxidation

### Brominated Organic Wastes

Biological Treatment
Air Stripping
Reverse Osmosis

### Organo-nitrogen Compound Wastes

Biological Treatment
Carbon Adsorption
PACT$^{R}$ Treatment
Steam Stripping
Wet Air Oxidation
Solvent Extraction
Chemical Reduction

### Organo-sulfur Compound Wastes

No technologies identified.

Based on the technologies listed above, and technologies identified for other similar organic constituents, the Agency considers the following technologies to be demonstrated for wastewater forms of the U and P wastes included in this document:

- Wet air oxidation followed by carbon adsorption;
- Chemical oxidation followed by carbon adsorption; and
- Biological treatment followed by carbon adsorption.

The Agency is not aware of any facilities that incinerate wastewater forms of the U and P wastes included in this document. However, commenters to the Second Third proposed rule indicated that they were indeed incinerating many wastewaters and that they did not want to be precluded from doing so. Since incineration is demonstrated for treatment of waste constituents in nonwastewater forms of these wastes as discussed in Section 3.2.1, the Agency believes incineration is also demonstrated for these waste constituents in wastewater forms of these wastes. Therefore, the Agency is also identifying incineration as a demonstrated technology for wastewaters.

Although the Agency believes that recycling and reuse is applicable for off-specification U and P wastes, the Agency is not aware of any facilities that do so. Therefore, recycle and reuse is not considered to be demonstrated for these wastes at this time.

## 3.3 Available Treatment Technologies

An available treatment technology is one that (1) is not a proprietary or patented process that cannot be purchased or licensed from the proprietor (i.e., it must be commercially available), and (2) substantially diminishes the toxicity of the waste or substantially reduces the likelihood of migration of hazardous constituents from the waste.

The demonstrated technologies identified in Section 3.2 are all commercially available. Treatment performance data included in Section 4.0 show substantial treatment by incineration for waste constituents of concern and other similar constituents. Treatment performance data included in the

Wastewater Background Document (Reference 3) show substantial treatment by wet air oxidation, carbon adsorption, biological treatment, and chemical oxidation. Therefore, these technologies are "available" for treatment of the wastes included in this document.

## 3.4 Identification of BDAT

For a treatment technology to be identified as BDAT, the treatment performance data are first screened to determine:

- Whether the data represent operation of a well-designed and well-operated treatment system;
- Whether sufficient analytical quality assurance/quality control measures were employed to ensure the accuracy of the data; and
- Whether the appropriate measure of performance was used to assess the performance of the particular treatment technology.

With the exception of the ethylene dibromide test burn, all of the incineration data included in Section 4.0 represent BDAT for wastes included in this and previous rulemakings and therefore meet the above conditions. Treatment performance data and design and operating data for the ethylene dibromide test burn are included in Section 4.0. The ethylene dibromide treatment system was well-designed and well-operated and sufficient analytical quality assurance/-quality control measures were employed. The appropriate measure of performance (total constituent concentration) was used to assess the treatment system. Therefore, incineration is proposed BDAT for nonwastewater forms of these wastes for each treatability group.

Since wet air oxidation followed by carbon adsorption, chemical oxidation followed by carbon adsorption, and incineration are demonstrated for wastewaters as discussed in Section 3.2.2, the Agency is proposing these technologies as BDAT for wastewater forms of the U and P wastes included in this document. The Agency is also proposing biological treatment followed by carbon adsorption as BDAT for wastewaters that cannot be quantified in hazardous waste matrices using current analytical methods in the wastes of a pharmaceutical nature, organo-sulfur compound wastes, and organo-nitrogen compound wastes treatability groups.

Biodegradation has not been specified as BDAT for wastes that cannot be quantified in hazardous waste matrices using current analytical methods in the miscellaneous halogenated organic treatability group since the Agency believes that these wastes may not be amenable to biological treatment. An exception is bromoacetone (P017) in the brominated organics treatability group. The Agency believes that this constituent is amenable to biodegradation due to its instability in water. Therefore, the Agency is proposing biological treatment followed by carbon adsorption as BDAT for P017 wastewaters.

## 4.0 TREATMENT PERFORMANCE DATA BASE

This section presents the data available to EPA on the performance of treatment technologies that are demonstrated for wastes in the miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, brominated organic wastes, organo-sulfur compound wastes, and organo-nitrogen compound wastes treatability groups. Table 2-4 summarized the specific waste codes included in each treatability group and the availability of analytical methods for analysis of each waste constituent. Treatment performance data are not appropriate as a means of regulating those waste constituents that are not amenable to quantification in hazardous waste matrices using current analytical methods. Wastewater treatment data from EPA's Office of Water and EPA-conducted wastewater treatment tests were not available in time for incorporation into this document; these data are included in the Wastewater Background Document (Reference 3) and in the administrative record for this rulemaking as discussed in Section 1.2.

The available treatment performance data are used elsewhere in this document to determine which technologies represent BDAT (Section 3.0), to select constituents for proposed regulation (Section 5.0), and to develop proposed treatment standards (Section 6.0). In addition to using treatment performance data from full-scale operations, eligible data may include those developed at research facilities or obtained at less than full-scale operations, provided that the technology is demonstrated in full-scale operation for a similar waste or wastes (as described in Section 3.0).

In an effort to account for the wide range of physical forms for U and P wastes, EPA examined all available BDAT incineration data to develop treatment standards. Specifically, the Agency considered treatment performance data from the fourteen EPA-conducted incineration tests listed in Table 4-1. Plant codes cited in Table 4-1 are included in Appendix B. In cases where an individual waste constituent of concern was detected in the untreated or treated wastes from one or more treatment tests, data from only those tests were used to develop treatment standards for that constituent. In cases where an individual waste constituent of concern was not detected in any of the untreated or treated wastes from the fourteen treatment tests, detection limits achieved for that constituent in ash and scrubber water residuals from all the tests were used to develop treatment standards as discussed in Section 6.0.

Treatment performance data, to the extent that they are available to EPA, include the concentrations for a given constituent in the untreated and treated wastes, values of operating parameters measured at the time the waste was treated, and values of relevant design parameters for the treatment technology. Only treatment performance data for the waste constituents of interest are presented in this section. Values of design and operating parameters for each treatment test can be found in the corresponding On-Site Engineering Report for each test.

In most cases, multiple sets of treatment performance data were used to develop proposed treatment standards for the treatability groups presented in Table 2-4. The methodology used to develop these treatment standards is discussed in more detail in Section 6.0, and the data that were used to develop proposed treatment standards for these wastes are presented in this section.

For each treatability group, two data tables are presented. The first table for each group shows which waste constituents were detected in the untreated waste, incinerator ash, or scrubber water in any of the fourteen tests listed in Table 4-1. This first table includes the constituent concentrations and the corresponding test number (referring to Table 4-1). The second table presents the detection limits (incinerator ash and scrubber water) for all fourteen tests for those waste constituents that were not detected in the untreated waste, incinerator ash, or scrubber water in any of the treatment tests.

## 4.1 Miscellaneous Halogenated Organic Wastes

Table 4-2 presents the waste constituents that were detected in untreated waste, ash, or scrubber water samples in at least one of the fourteen tests listed in Table 4-1. Waste constituents for the following wastes were detected: U017, U025, U043, U045, U073, U075, and U192; two of these, U045 and U075, were detected in more than one of the fourteen tests. Table 4-3 presents the waste constituents that were not detected in any of the fourteen tests and the highest detection limits for those waste constituents in ash and scrubber water in each test.

Chlorinated Diphenyls. Performance data for incineration of 3,3'-dichlorobenzidine (U073) are presented in Table 4-2. No performance data are available for treatment of U158. However, treatment performance data are available for similar waste constituents, Pronamide and Methoxychlor. Treatment performance data for Pronamide are included in Table 4-2, and treatment performance data for Methoxychlor are presented in Appendix E-1. Both Methoxychlor and Pronamide were treated to detection limits in incinerator ash and scrubber water. The Agency believes that the structural complexity of Pronamide, a halogenated organo-nitrogen compound, makes this constituent more difficult to treat than U073 and U158. The Agency also believes that the chlorines at the carbon bridge in Methoxychlor stabilize the Methoxychlor aromatic ring such that it is more difficult to incinerate than U073 and U158. Therefore, the Agency believes that U073 and U158 can also be incinerated to detection limits in incinerator ash and scrubber water.

Chlorinated Polynuclear Aromatics. Performance data are not available for incineration of U047 or U026. However, treatment performance data are available for a similar waste constituent, Pronamide. These data are included in Table 4-2. Pronamide was treated to detection limits in incinerator ash and scrubber water. The Agency believes that the structural complexity of Pronamide, a halogenated organo-nitrogen compound, make this constituent more difficult to treat than U047 and U026. Therefore, the Agency believes that U047 and U026 can also be incinerated to detection limits in incinerator ash and scrubber water.

Chlorinated Amines, Amides, and Nitriles. Performance data are available for incineration of Pronamide (U192). Pronamide was treated to detection limits in the incinerator ash and scrubber water as demonstrated by the treatment performance data included in Table 4-2. The Agency believes that p-chloroaniline (P024) resembles Pronamide closely enough that incineration will also destroy p-chloroaniline to detection limits. In addition, the Agency believes that Pronamide is more difficult to treat than P027, P057, and U091 since these constituents are halogenated aliphatics and are expected to be less stable than Pronamide (an aromatic molecule). U049 and U222 are expected to exhibit similar treatability to Pronamide since they are polar aromatic, similar in chemical stability to Pronamide.

Chlorinated Methylbenzenes. Performance data are available for liquid injection incineration of benzal chloride (U017); however, no data are available for benzal chloride (U017) in incinerator ash as indicated in Table 4-2. Due to the limited amount of available treatment performance data for benzal chloride, the Agency is transferring performance data from treatment of a similar waste. Sources of treatment performance data for potential transfer to U017 include wastes previously tested by incineration. (This technology was identified as applicable and demonstrated for treatment of U017 in Section 3.0.) Wastes previously tested by the Agency by incineration are listed in Table 4-1. EPA examined these wastes to identify the best source(s), if any, for transfer of treatment performance data to U017 nonwastewaters and wastewaters. Specifically, EPA examined whether the untested wastes are (1) generated from similar industries or processing steps and (2) whether the wastes have similar waste characteristics affecting treatment performance as these previously-tested wastes.

K015 treated in test 12 (see Table 4-1) is still bottoms from the distillation of benzyl chloride. K015 treated on test 12 is comprised of 88% benzal chloride. K015 is also generated from the final purification step in the production of benzal chloride. Therefore, K015 is expected to closely resemble U017 generated as discarded commercial chemical products, manufacturing chemical intermediates, and off-specification commercial chemical products. U017 generated as spill residues contain lower concentrations benzal chloride and are expected to be treatable to concentrations as low as those in treated K015. Based on these similarities, the Agency is transferring performance data from incineration of benzal chloride in test 12 to U017 for the purpose of developing numerical treatment standards. However, incinerator ash was not generated during treatment of K015 and treatment standards for nonwastewaters cannot be developed based on the K015 incineration data. Table 4-4 presents the BDAT list constituents detected in untreated K015 from test 12. Table 4-5 presents the BDAT List constituents detected in the scrubber water residual from test 12. Design and operating data for the liquid injection incinerator from test 12 are presented in Table 4-6. Additional details of test 12 may be found in the Onsite Engineering Report for test 12 (Reference 21).

K019 waste treated in test 4 (see Table 4-1) is heavy ends from the distillation of ethylene dichloride in ethylene dichloride production. K019 waste treated in test 4 is comprised of nearly 100% chlorinated organic compounds. U017 is also expected to contain high concentrations of benzal chloride, a chlorinated organic chemical. Based on these similarities, the Agency is transferring performance data from incineration of K019 to develop treatment standards for U017 nonwastewaters. Specifically, the Agency is transferring performance data from incineration of p-dichlorobenzene. The Agency believes that this transfer is technically valid because p-dichlorobenzene is most structurally similar to benzal chloride and is expected to exhibit similar treatability. Table 4-7 presents the BDAT List constituents detected in the untreated wastes from test 4. Table 4-8 presents the BDAT List constituents detected in the kiln ash residual from test 4. Design and operating data for the rotary kiln and secondary combustor from test 4 are presented in Table 4-9. Additional details of test 4 may be found in the Onsite Engineering Report for test 4 (Reference 12).

Performance data are not available for incineration of P028; however, treatment performance data are available for similar waste constituents: p-dichlorobenzene in K019 and Pronamide. Both Pronamide and p-dichlorobenzene were treated to detection limits in the incinerator ash and scrubber water. The Agency believes that p-dichlorobenzene and Pronamide are more difficult to treat than P028. Therefore, the Agency believes that P028 can be treated to similar concentrations in incinerator ash and scrubber water.

Halogenated Aliphatics. Performance data are available for incineration of vinyl chloride, chloromethane, and dichlorodifluoromethane. These constituents were treated to detection limits in the incinerator ash and scrubber water as demonstrated by the treatment performance data included in Table 4-2. Treatment performance data are also available for similar waste constituents, 1,1,1-trichloroethane and carbon tetrachloride, and are included in Appendix E.1. 1,1,1-Trichloroethane and carbon tetrachloride were treated to detection limits in incinerator ash and scrubber water. 1,1,1-Trichloroethane and carbon tetrachloride contain one or two carbons with three or four chlorines attached and are expected to exhibit similar treatability as the wastes included in this group. While the carbon-fluoride bonds in U075 and U121 are known to be much stronger than the carbon-chlorine bond in the carbon tetrachloride molecule, EPA believes that the overall degree of difficulty of treatment is similar. Therefore, the Agency believes that these halogenated aliphatic wastes can be incinerated to detection limits in incinerator ash and scrubber water.

Halogenated Aldehydes, Ethers, and Esters. Performance data for incineration of bis(2-chloroethyl)ether (U025) are presented in Table 4-2. No performance data are available for treatment of the other waste constituents in this group. However, treatment performance data are available for similar waste constituents, Pronamide and chlorobenzene. Treatment performance data for Pronamide are included in Table 4-2, and treatment performance data for chlorobenzene are presented in Appendix E-2. Both Pronamide and chlorobenzene were treated to detection limits in incinerator ash and scrubber water. The Agency believes that Pronamide, a halogenated organo-nitrogen compound, and chlorobenzene are more difficult to treat than the waste constituents included in this group because they have more complex chemical structures and stronger chemical bonds. Therefore, the Agency believes that the wastes included in this group can also be incinerated to detection limits in incinerator ash and scrubber water.

Chlorinated Organo-Sulfur Compounds. Performance data are not available for incineration of P026, P118, U020, or U062. However, treatment performance data are available for similar waste constituents, 1,1,1-trichloroethane, tetrachloroethene, Pronamide, and chlorobenzene. Treatment performance data for Pronamide are included in Table 4-2, and treatment performance data for 1,1,1-trichloroethane are included in Appendix E.1. Treatment performance data for tetrachloroethene and chlorobenzene are included in Appendix E.2. All of these constituents were treated to detection limits in incinerator ash and scrubber water. The Agency believes that 1,1,1-trichloroethane, tetrachloroethene, Pronamide, and chlorobenzene exhibit similar treatability as the wastes included in this group.

## 4.2 Wastes of a Pharmaceutical Nature

Only one pharmaceutical waste constituent, isosafrole (U141), was detected in the untreated or treated wastes from any of the fourteen treatment tests. These data are summarized in Table 4-10. Table 4-11 presents the detection limits for those waste constituents that were not detected in any of the fourteen tests. Isosafrole was incinerated to detection limits in incinerator ash and scrubber water. The Agency believes that the structural size and complexity of isosafrole is similar to that of the remaining waste constituents in this group and that all of these wastes should exhibit similar treatability. Therefore, the Agency believes that all of the wastes included in this treatability group can be incinerated to detection limits in incinerator ash and scrubber water.

## 4.3 Brominated Organic Wastes

The Agency has treatment performance data for rotary kiln incineration of ethylene dibromide at Rollins Environmental Services, Deer Park, Texas. These data were used to develop treatment standards for U067 (ethylene dibromide) and were transferred to the remaining waste codes in the brominated organics treatability group. Treatment performance data for the untreated waste feed and the incinerator ash and scrubber water treatment residuals are included in Table 4-12. Design and operating data for the treatment systems used for the ethylene dibromide test burn are included in Table 4-13.

## 4.4 Organo-sulfur Compound Wastes

The Agency is not developing numerical treatment standards for these wastes since many of the waste constituents are not amenable to quantification in hazardous waste matrices using current analytical methods and since the Agency is requesting more data on incineration of these wastes before developing numerical treatment standards. Therefore, treatment performance data tables for these waste constituents are not included in this section.

## 4.5 Organo-nitrogen Compound Wastes

Table 4-14 presents the nitrogen functional group waste constituents that were detected in untreated or treated waste samples in at least one of the fourteen tests listed in Table 4-1. Five waste constituents were detected (U003, U009, U012, U169, and U196). None of these waste constituents were detected in the ash or scrubber water residuals.

Table 4-15 presents the waste constituents in the nitrogen functional group that were not detected in any of the fourteen tests and the detection limits for those waste constituents in each test. No data for acrylamide (U007) are available for incinerator ash or scrubber water as indicated in Table 4-9.

Nitrogen Heterocyclic Compounds. Performance data for incineration of pyridine (U196) are presented in Table 4-14. No performance data are available for the remaining waste constituents in this group. However, treatment performance data are available for a similar waste constituent, Pronamide. These data are included in Table 4-2. Pronamide was treated to detection limits in incinerator ash and scrubber water. The Agency believes that the structural complexity of Pronamide, a halogenated organo-nitrogen compound, makes this constituent more difficult to treat than the nitrogen heterocyclic compounds. Therefore, the Agency believes that the nitrogen heterocyclic compounds can also be incinerated to detection limits in incinerator ash and scrubber water.

Amine and Amide Compounds. Performance data for incineration of aniline (U012) are presented in Table 4-14. No performance data are available for the remaining waste constituents in this group. However, since aniline was incinerated to detection imits in the incinerator ash and scrubber water, the Agency believes that the other amine and amide compounds included in this group can also be incinerated to detection limits in incinerator ash and scrubber water.

Aminated Diphenyls and Biphenyls. No performance data are available for incineration of any of the wastes included in this group. However, treatment performance data are available for similar waste constituents, Pronamide and Methoxychlor. Treatment performance data for Pronamide are included in Table 4-2, and treatment performance data for Methoxychlor are presented in Appendix E.1. Both Methoxychlor and Pronamide were treated to detection limits in incinerator ash and scrubber water. The Agency believes that the structural complexity of Pronamide, a halogenated organo-nitrogen compound, makes this constituent more difficult to treat than the aminated diphenyls and biphenyls. The Agency also believes that the chlorines at the carbon bridge in Methoxychlor stabilize the Methoxychlor aromatic ring such that it is more difficult to incinerate than the aminated diphenyls and biphenyls. Therefore, the Agency believes that the aminated diphenyls and biphenyls can also be incinerated to detection limits in incinerator ash and scrubber water.

Nitriles. Performance data for incineration of acetonitrile (U003) and acrylonitrile (U009) are presented in Table 4-14. No performance data are available for the remaining waste constituents in this group. However, treatment performance data are available for similar waste constituents, 1,1,1-trichloroethane and Pronamide. Treatment performance data for 1,1,1-trichloroethane are presented in Appendix E.1, and treatment performance data for Pronamide are presented in Table 4-2. 1,1,1-Trichloroethane and Pronamide were incinerated to detection limits in incinerator ash and scrubber water. The Agency believes that both 1,1,1-trichloroethylene and Pronamide are more difficult to incinerate than the waste constituents in this group. Therefore, the Agency believes that the nitrile compounds can also be incinerated to detection limits in incinerator ash and scrubber water.

Nitro Compounds. Performance data for incineration of nitrobenzene (U169) are presented in Table 4-14. No performance data are available for the remaining waste constituents in this group. Since nitrobenzene was incinerated to detection limits in the incinerator ash and scrubber water, the Agency believes that the other nitro compounds included in this group can be incinerated to detection limits in incinerator ash and scrubber water.

Nitroso Compounds. No performance data are available for incineration of any of the wastes included in this group. However, treatment performance data are available for a similar waste constituent, Pronamide. These data are included in Table 4-2. Pronamide was treated to detection limits in incinerator ash and scrubber water. The Agency believes that the structural complexity of Pronamide, a halogenated organo-nitrogen compound, makes this constituent more difficult to treat than the nitroso compounds. Therefore, the Agency believes that the nitroso compounds can also be incinerated to detection limits in incinerator ash and scrubber water.

## Table 4-1

## WASTES TESTED BY INCINERATION

| Test Number | Waste Code(s) Tested | Technology Used |
|---|---|---|
| 1 | K001-Pentachlorophenol Waste | Rotary Kiln |
| 2 | K001-Creosote Waste | Rotary Kiln |
| 3 | K011,K013,K014 | Rotary Kiln |
| 4 | K019 | Rotary Kiln |
| 5 | K024 | Rotary Kiln |
| 6 | K037 | Rotary Kiln |
| 7 | K048,K051 | Fluidized Bed |
| 8 | K087 | Rotary Kiln |
| 9 | K101 | Rotary Kiln |
| 10 | K102 | Rotary Kiln |
| 11 | F024 | Rotary Kiln |
| 12 | K015 | Liquid Injection |
| 13 | D014,D016,P059*,U127*,U192* | Rotary Kiln |
| 14 | U141*,U028*,P020*,U112*,U226*,<br>U239*,U080*,U220*,U166*,U161*,<br>U188* | Rotary Kiln |

* Commercial chemical products were used in these test burns as surrogates for these wastes.

TABLE 4-2

CONCENTRATIONS OF WASTE CONSTITUENTS DETECTED IN THE UNTREATED OR TREATED WASTES - MISCELLANEOUS HALOGENATED ORGANIC WASTES

| Waste Code | BDAT # | Waste Constituent | Treatment Test Detected In (#)* | Concentration In Untreated Waste (ppm)** | Concentration In Ash (ppm/[# of sample sets])** | Concentration In Scrubber Water (ppm/[# of sample sets])** |
|---|---|---|---|---|---|---|
| U045 | 15 | Chloromethane | 5 | <2-40 | <2 [3] | <0.002 [10] |
| | | | 11 | <20,000 | <0.01 [6] | <0.01 [5], 0.02 [1] |
| U075 | 21 | Dichlorodifluoromethane | 4 | <200 | <2 [6] | <0.002 [4], 4.3 [1], 14 [1] |
| | | | 7 | <14-310 | <2 [6] | <0.05 [6] |
| | | | 11 | <20,000 | 0.071 [1], 1.4 [1], 1.5 [1], 1.6 [1], 1.7 [1], 1.4 [1] # | <0.01 [2], 0.29 [1], 0.36 [1], 0.4 [1], 0.44 [1] |
| | | | 5 | <2 | <2 [2], 23 [1] | <0.002 [9], 0.023 [1] |
| U043 | 50 | Vinyl chloride | 11 | <20,000 | <0.01 [6] | <0.01 [5], 0.03 [1] |
| U025 | 68 | Bis(2-chloroethyl)ether | 4 | 280-340 | <2 [6] | <0.002 [6] |
| U073 | 89 | 3,3'-Dichlorobenzidine | 11 | <940 | <1.67 [5], <1.76 [1] | 0.058 [1], 0.0605 [1], 0.054 [1], 0.052 [1], 0.053 [1], 0.0535 [1] ## |
| U192 | 144 | Pronamide | 13 | 24,000 | <0.33 [2], 0.36 [1], 0.31 [1] | <0.01 [2], <0.011 [2] |
| U017 | 218 | Benzal chloride | 12 | 910,000-1,100,000 | NA | <0.05 [1], 0.066 [1], 0.094 [1] |

* - Treatment test # is indicated in Table 4-1.
** - Number in parenthesis indicates the number of sample sets the value was reported.
# - The highest detection limit for this treatment test is 0.01 ppm.
## - The highest detection limit for this treatment test is 0.0605 ppm.
NA - Incinerator ash was not generated in this test.

TABLE 4-3

DETECTION LIMITS FOR CONSTITUENTS IN THE MISCELLANEOUS HALOGENATED ORGANIC WASTES
NOT QUANTIFIED ABOVE DETECTION LIMITS

| Waste Code | BDAT # | Constituent Test No.* -> | Detection Limit (ppm) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Incinerator Ash | | | | | | | | | | | | | | | | |
| U042 | 13 | 2-Chloroethyl vinyl ether | 0.2 | 100 | 0.2 | NA | 0.2 | 200 | NA | 0.05 | 0.01 | 3 | 0.01 | ** | NA | NA |
| U138 | 32 | Iodomethane | 2 | 20 | 0.002 | 2 | 2 | 2 | 2 | 0.25 | 0.05 | 15 | 0.05 | ** | 2 | 2 |
| U121 | 48 | Trichlorofluoromethane | 2 | 10 | 0.002 | 2 | 2 | 2 | 2 | 0.025 | 0.005 | 1.5 | 0.005 | ** | 2 | 2 |
| U024 | 67 | Bis(2-chloroethoxy)methane | 0.5 | 0.36 | 0.01 | 2 | 0.5 | 0.4 | 0.2 | NA | 0.42 | 1 | 0.351 | ** | 0.4 | 0.5 |
| U027 | 69 | Bis(2-chloroisopropyl)ether | 0.5 | 0.38 | 0.351 | 2 | 0.5 | 0.4 | 0.2 | 1 | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| P024 | 74 | p-Chloroaniline | 5 | 0.67 | 0.351 | 5 | 5 | 0.4 | 0.5 | 1 | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| U047 | 77 | 2-Chloronaphthalene | 0.5 | 0.13 | 0.351 | 2 | 0.5 | 0.4 | 0.2 | 1 | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| U158 | 120 | 4,4'-Methylenebis(2-chloroaniline) | 10 | NA | 0.702 | NA | 10 | 7 | NA | 2 | 0.84 | 2 | 0.702 | ** | 0.36 | 0.36 |
| Scrubber Water | | | | | | | | | | | | | | | | |
| U042 | 13 | 2-Chloroethyl vinyl ether | 0.0002 | 0.1 | 0.2 | NA | 0.0002 | 0.2 | 0.05 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | NA | NA |
| U138 | 32 | Iodomethane | 0.002 | 0.02 | 0.002 | 0.002 | 0.002 | 0.002 | 0.0042 | 0.05 | 0.05 | 0.05 | 0.05 | 0.002 | 0.005 | 0.005 |
| U121 | 48 | Trichlorofluoromethane | 0.002 | 0.01 | 0.002 | 0.002 | 0.002 | 0.002 | 0.047 | 0.005 | 0.005 | 0.005 | 0.005 | 0.002 | 0.005 | 0.005 |
| U024 | 67 | Bis(2-chloroethoxy)methane | 0.01 | 0.006 | 0.01 | 0.002 | 0.01 | 0.01 | 0.01 | NA | 0.01 | 0.01 | 0.0121 | 0.01 | 0.011 | 0.013 |
| U027 | 69 | Bis(2-chloroisopropyl)ether | 0.01 | 0.006 | 0.01 | 0.002 | 0.01 | 0.01 | 0.01 | NA | 0.01 | 0.01 | 0.0121 | 0.01 | 0.011 | 0.013 |
| P024 | 74 | p-Chloroaniline | 0.1 | 0.011 | 0.1 | 0.005 | 0.02 | 0.1 | 0.02 | 0.01 | 0.01 | 0.01 | 0.0121 | 0.1 | 0.011 | 0.013 |
| U047 | 77 | 2-Chloronaphthalene | 0.01 | 0.002 | 0.01 | 0.002 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.0121 | 0.01 | 0.011 | 0.013 |
| U158 | 120 | 4,4'-Methylenebis(2-chloroaniline) | 0.2 | NA | 0.2 | NA | 0.2 | 0.2 | 0.01 | 0.01 | 0.02 | 0.02 | 0.0242 | 0.2 | 0.011 | 0.013 |

* - Treatment test # is indicated in Table 4-1.
** - Incinerator ash samples were not collected for Test 12.
NA - Not Available

Table 4-4

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K015 TREATED BY LIQUID INJECTION INCINERATION

| BDAT List Constituent | K015 Wastes Fed to the Incineration (ppm) |
|---|---|
| SEMIVOLATLE ORGANICS (ppm) * | |
| Benzal chloride | 910,000 - 1,100,000 |
| OTHER PARAMETERS | |
| Ash content (%) | 0.01 - 0.29 |
| Heating value (BTU/lb) | 10,000 |
| Carbon content (%) | 51.0 - 51.3 |
| Sulfur content (%) | 0.03 - 0.32 |
| Water content (%) | < 1 |

* Only one BDAT List constituent, benzal chloride, was detected in the untreated K015 waste.

## Table 4-5

## TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K015 TREATED BY LIQUID INJECTION INCINERATION

| BDAT List Constituent | Concentration in Scrubber Water (ppm) Sample set #1 | Sample set #2 | Sample set #3 |
|---|---|---|---|
| VOLATILE ORGANICS | | | |
| 43. Toluene | 0.059 | 0.03 | 0.015 |
| SEMIVOLATILE ORGANICS | | | |
| 218. Benzal chloride | < 0.05 | 0.066 | 0.094 |
| METALS | | | |
| 154. Antimony | < 0.012 | 0.12 | 0.16 |
| 155. Arsenic | 0.25 | 0.1 | 0.53 |
| 156. Barium | 0.11 | 0.25 | 0.55 |
| 157. Beryllium | < 0.005 | < 0.05 | < 0.005 |
| 158. Cadmium | < 0.02 | 0.02 | < 0.02 |
| 159. Chromium | 4 | 18 | 34 |
| 160. Copper | 0.58 | 1.6 | 3.5 |
| 161. Lead | 0.06 | 0.24 | 0.3 |
| 162. Mercury | 0.005 | < 0.0025 | 0.06 |
| 163. Nickel | 2.2 | 11 | 25 |
| 164. Selenium | 0.06 | 0.09 | 0.06 |
| 165. Silver | 0.13 | 0.3 | < 0.035 |
| 166. Thallium | < 0.75 | < 0.75 | < 0.75 |
| 167. Vanadium | 0.05 | 0.17 | 0.39 |
| 168. Zinc | 0.11 | 0.75 | 0.93 |

Note: This table shows the concentrations in the scrubber water for all constituents that were detected in the wastewaster residuals generated from treatment of the waste.

SOURCE: Onsite Engineering Report for K015 (Reference 21).

## Table 4-6

## DESIGN AND OPERATING DATA FOR THE LIQUID INJECTION INCINERATOR AND COMBUSTION GAS SCRUBBER

| Parameter (units) | Sample Set #1 | Sample Set #2 | Sample Set #3 |
|---|---|---|---|
| KILN | | | |
| Temperature (F) | 1841 - 2013 | 2001 - 2077 | 1780 - 2065 |
| Feed rate (lb/min) | 4.14 - 4.5 | 4.48 - 4.55 | 4.18 - 6.22 |
| Excess oxygen (%) | 3.74 - 5.29 | 3.29 - 5.12 | 3.17 - 5.77 |
| Carbon monoxide (ppm) | 0 - 520 | 0 - 80 | 0 - 614 |
| SCRUBBER | | | |
| Flow (gal/min) | 17.44 | 17.44 | 17.44 |
| Pressure drop (in. of water) | 40 - 44 | 40 - 41 | 38 - 40 |

SOURCE : Onsite Engineering Report for K015 (Reference 21).

Table 4-7

## WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| BDAT List Constituent | | Wastes fed to the Rotary Kiln[a] K019 (ppm) | Wastes fed to the Rotary Kiln[a] RCRA Blend (ppm) | Wastes fed to the Secondary Combustor PCB Blend (ppm) | Wastes fed to the Secondary Combustor Mercaptan-Contaminated Waste (ppm) |
|---|---|---|---|---|---|
| VOLATILES | | | | | |
| 4. | Benzene | <2,000 | 2,000 | <2,000 | 17.0 |
| 7. | Carbon tetrachloride | 3,500-4,100 | <8 | <2,000 | 1.9 |
| 9. | Chlorobenzene | <2,000-3,000 | <8 | <2,000 | <0.4 |
| 14. | Chloroform | 4,600-6,000 | <8 | <2,000 | <0.4 |
| 22. | 1,1-Dichloroethane | <2,000-2,200 | <8 | <2,000 | <0.4 |
| 23. | 1,2-Dichloroethane | 87,000-130,000 | <8 | <2,000 | <0.4 |
| 34. | Methyl ethyl ketone | <10,000 | 940 | <10,000 | 3.5 |
| 38. | Methylene chloride | <10,000 | 910 | <10,000 | <2.0 |
| 42. | Tetrachloroethene | 6,000-7,800 | 490 | <10,000 | <0.4 |
| 43. | Toluene | <2,000 | 2,300 | <2,000 | 3.7 |
| 45. | 1,1,1-Trichloroethane | 33,000-81,000 | 130 | <2,000 | 2.3 |
| 47. | Trichloroethene | 2,200-3,210 | 360 | 3,600 | <0.4 |
| 215-217. | Xylene (total) | <2,000 | 3,400 | 36,000 | 4.4 |
| 222. | Acetone | <10,000 | 1,200 | <10,000 | <2.0 |
| 226. | Ethyl benzene | <2,000 | 2,200 | 16,000 | 4.1 |
| 229. | Methyl isobutyl ketone | <10,000 | 1,100 | <10,000 | <2.0 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. Only one sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

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Table 4-7 (Continued)

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019
AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| | | Wastes fed to the Rotary Kiln[a] | | Wastes fed to the Secondary Combustor | |
|---|---|---|---|---|---|
| | BDAT List Constituent | K019 (ppm) | RCRA Blend (ppm) | PCB Blend (ppm) | Mercaptan-Contaminated Waste (ppm) |
| | SEMIVOLATILES | | | | |
| 51. | Acenaphthalene | <10 | 150 | 120 | <0.002 |
| 52. | Acenaphthene | <10 | <20 | 480 | <0.002 |
| 56. | Aniline | <25 | <50 | <250 | 1.220 |
| 57. | Anthracene | <10 | 110 | 400 | <0.002 |
| 65. | Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 |
| 68. | Bis(2-chloroethyl)ether | 280-340 | <20 | <100 | <0.002 |
| 70. | Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 |
| 80. | Chrysene | SNA | 28 | <100 | <0.002 |
| 81. | ortho-Cresol | <10 | <20 | <100 | 0.020 |
| 87. | o-Dichlorobenzene | <10 | 250 | 1,060 | 2.550 |
| 88. | p-Dichlorobenzene | 74-90 | 32 | 460 | 0.260 |
| 90. | 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 |
| 91. | 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. One sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

## Table 4-7 (Continued)

## WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| | Wastes fed to the Rotary Kiln[a] | | Wastes fed to the Secondary Combustor | |
|---|---|---|---|---|
| BDAT List Constituent | K019 (ppm) | RCRA Blend (ppm) | PCB Blend (ppm) | Mercaptan-Contaminated Waste (ppm) |
| SEMIVOLATILES (Cont.) | | | | |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 |
| 109. Fluorene | 16-22 | 53 | 340 | <0.002 |
| 110. Hexachlorobenzene | 60-87 | <100 | <500 | 0.022 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 |
| 113. Hexachloroethane | 85-120 | <100 | <500 | 0.018 |
| 121. Naphthalene | 314-470 | <20 | 400 | 0.133 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 |
| 136. Pentachlorobenzene | 51-65 | <100 | 1,000 | 0.020 |
| 141. Phenanthrene | 11-21 | 240 | 950 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 62-86 | <50 | 1,400 | 0.008 |
| 150. 1,2,4-Trichlorobenzene | 65-100 | <50 | 9,000 | 1.24 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. One sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

Table 4-7 (Continued)

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019
AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| | Wastes fed to the Rotary Kiln[a] | | Wastes fed to the Secondary Combustor | |
|---|---|---|---|---|
| BDAT List Constituent | K019 (ppm) | RCRA Blend (ppm) | PCB Blend (ppm) | Mercaptan-Contaminated Waste (ppm) |
| METALS | | | | |
| 155. Arsenic | <0.2-1.2 | 94 | 7.4 | <0.02 |
| 156. Barium | <0.9-0.97 | 1.3 | <19 | 1.67 |
| 158. Cadmium | <0.3-0.63 | <0.3 | <33 | <0.003 |
| 159. Chromium | 1.8-5.3 | 40 | 23.7 | <0.009 |
| 160. Copper | <1.0-3.6 | 165 | 107 | 0.027 |
| 161. Lead | 2.1-3.5 | 27 | <7.3 | 0.0064 |
| 163. Nickel | 2.2-6.0 | 8.8 | 6.2 | 0.037 |
| 168. Zinc | 4.4-9.4 | 4,170 | 6810 | 0.071 |
| INORGANICS | | | | |
| 171. Sulfide | 790 | 830 | 16,000 | 17 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. One sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

# Table 4-8

## TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

## KILN ASH RESIDUAL

| BDAT List Constituent | DETECTION LIMIT | Concentration in Kiln Ash - Total Concentration (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|
| | | SAMPLE SET #1 | SAMPLE SET #2 | SAMPLE SET #3 | SAMPLE SET #4 | SAMPLE SET #5 | SAMPLE SET #6 |
| SEMIVOLATILES | | | | | | | |
| 70. Bis(2-ethylhexyl)phthalate | 2 | ND | ND | ND | 12 | ND | ND |
| 72. Di-n-butyl phthalate | 2 | ND | ND | ND | 230 | ND | ND |
| METALS | | | | | | | |
| 154. Antimony | 6.0 | 8.0 | 6.8 | 9.2 | ND | 9.1 | 9.6 |
| 155. Arsenic | 0.2 | 3.6 | 2.8 | 5.7 | 5.7 | 3.9 | 2.3 |
| 156. Barium | 0.9 | 26 | 23 | 54 | 8.4 | 21 | 11 |
| 158. Cadmium | 0.3 | 0.66 | 0.96 | 3.6 | ND | 1.2 | 2.2 |
| 159. Chromium | 0.9 | 44 | 60 | 202 | 28 | 125 | 141 |
| 160. Copper | 1.0 | 2370 | 3430 | 2290 | 1270 | 2780 | 2520 |
| 161. Lead | 0.2 | 120 | 42 | 118 | 25 | 86 | 34 |
| 163. Nickel | 2.0 | 66 | 89 | 169 | 69 | 166 | 288 |
| 165. Silver | 0.9 | 3.3 | 3.4 | 1.9 | 2.6 | 3.3 | 3.1 |
| 167. Vanadium | 2.0 | 4.1 | 4.8 | 6.0 | ND | 5.7 | 8.7 |
| 168. Zinc | 0.6 | 12 | 13 | 16 | 11 | 22 | 13 |
| INORGANICS | | | | | | | |
| 170. Fluoride | 2 | 38 | ND | 6.1 | 3.2 | 23 | 4.7 |
| 171. Sulfide | 50 | 68 | 5.1 | 64 | ND | 64 | 92 |

ND - The compound was not quantified at or above the detection limit.

Note: This table shows the concentrations in the kiln ash for all constituents that were detected in the nonwastewater residuals generated from treatment of the waste.

Source: Onsite Engineering Report for K019 (Reference 12).

## Table 4-9

## DESIGN AND OPERATING DATA FOR THE ROTARY KILN AND SECONDARY COMBUSTOR

| Parameter (units) | Design Value | SAMPLE SET #1 | SAMPLE SET #2 | SAMPLE SET #3 | SAMPLE SET #4 | SAMPLE SET #5 | SAMPLE SET #6 |
|---|---|---|---|---|---|---|---|
| Kiln Outlet Temperature ($^oF$) | o | 1825-1900 | 1800-1880 | 1850-1900 | 1775-1900 | 1775-1800 | 1775-1850 |
| Kiln Solids Residence Time (min) | o | 120 | 120 | 120 | 120 | 120 | 120 |
| Kiln Waste Feed Rate (MMBTU/hr) | o | | | | | | |
| K019: | | 13.1 | 12.2 | 12.4 | 12.7 | 11.7 | 11.5 |
| RCRA Blend, Burner #1: | | 3.9-5.5 | 5.2-5.5 | 5.2-5.8 | 5.2-5.8 | 5.2-6.0 | 5.2-5.8 |
| RCRA Blend, Burner #2: | | 4.4-9.7 | 4.4-9.7 | 4.4-8.4 | 4.4-7.3 | 5.2-9.7 | 5.2-9.7 |
| | Total: | 21.4-28.3 | 21.8-27.4 | 22.0-26.6 | 22.3-25.8 | 22.1-27.4 | 21.9-27 |
| Kiln Rotational Speed (RPM) | o | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 |
| Afterburner Temperature ($^oF$) | o | 2380 | 2400 | 2400 | 2400 | 2400 | 2350 |
| Afterburner Residence Time (sec) | o | 2 | 2 | 2 | 2 | 2 | 2 |
| Afterburner Waste Feed Rate (MMBTU/hr) | | | | | | | |
| PCB Blend: | o | 36.1 | 36.5 | 36.5 | 36.5 | 37.5 | 37.5 |
| Mercaptan-Contaminated Waste: | | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 |
| | Total: | 36.28 | 36.68 | 36.68 | 36.68 | 37.68 | 37.68 |
| Stack Oxygen Concentration (%) | NA | 6.8 | 7.0 | 7.2 | 6.4 | 6.8 | 7.0 |
| Stack Carbon Monoxide Concentration (ppm volume) | NA | NR | NR | 0 | 0 | NR | NR |

o - This information has been claimed RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for the First Thirds Rulemaking of August 17, 1988.

Source: Onsite Engineering Report for K019 (Reference 12).

NA - Not applicable.
NR - Not recorded.

## TABLE 4-10

## CONCENTRATIONS OF WASTE CONSTITUENTS DETECTED IN THE UNTREATED OR TREATED WASTES - WASTES OF A PHARMACEUTICAL NATURE

| Waste Code | BDAT # | Waste Constituent | Treatment Test Detected In (#)* | Concentration In Untreated Waste (ppm)** | Concentration In Ash (ppm/[# of sample sets])** | Concentration In Scrubber Water (ppm/[# of sample sets])** |
|---|---|---|---|---|---|---|
| U141 | 117 | Isosafrole | 14 | 35,000 | <0.36 [1], <0.33 [3] | <0.013 [4] |

* - Treatment test # is indicated in Table 4-1.

** - Number in parenthesis indicates the number of sample sets the value was reported.

## TABLE 4-11

## DETECTION LIMITS FOR WASTE CONSTITUENTS IN WASTES OF A PHARMACEUTICAL NATURE NOT QUANTIFIED ABOVE DETECTION LIMITS

| | | | Detection Limit (ppm) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Waste Code | BDAT # | Constituent | Test No. * -> 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Incinerator Ash | | | | | | | | | | | | | | | | |
| U155 | 118 | Methapyrilene | NA | 0.8 | NA | NA | NA | NA | NA | NA | NA | NA | NA | ** | 0.36 | 0.36 |
| U187 | 140 | Phenacetin | 5 | NA | 0.702 | 2 | 5 | 4 | 0.2 | 2 | 0.84 | 2 | 0.702 | ** | 0.36 | 0.36 |
| U203 | 147 | Safrole | 5 | 0.17 | 1.76 | NA | 5 | 4 | NA | 5 | 2.1 | 5 | 1.76 | ** | 0.36 | 0.36 |
| Scrubber Water | | | | | | | | | | | | | | | | |
| U155 | 118 | Methapyrilene | NA | 0.012 | NA | NA | 0.1 | 0.1 | 0.01 | 0.01 | NA | NA | NA | NA | 0.011 | 0.013 |
| U187 | 140 | Phenacetin | 0.1 | NA | 0.1 | 0.002 | 0.1 | 0.1 | 0.01 | 0.01 | 0.02 | 0.02 | 0.0242 | 0.1 | 0.011 | 0.013 |
| U203 | 147 | Safrole | 0.1 | 0.003 | NA | NA | 0.1 | 0.1 | 0.01 | 0.01 | 0.05 | 0.05 | 0.0605 | 0.1 | 0.011 | 0.013 |

* - Treatment test # is indicated in Table 4-1.
** - Incinerator ash samples were not collected for Test 12.
NA - Not Available

Table 4-12

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR ETHYLENE DIBROMIDE AT ROLLINS ENVIRONMENTAL SERVICES, INC. (TEXAS) - INCINERATION *

| BDAT List Constituent | Detection Limit (mg/kg) | Conc. of EDB (mg/kg) | Detection Limit (mg/kg) | EDB in Solids Discharge Stream (mg/kg) | Detection Limit (mg/L) | EDB in Solids Discharge Stream (mg/L) |
|---|---|---|---|---|---|---|
| 1,2-Dibromoethane | 25,000 | 119,000 | 5 | < 5 | 5 | < 5 |
| | 25,000 | 92,000 | 5 | < 5 | 5 | < 5 |
| | 25,000 | 102,000 | 5 | < 5 | 5 | < 5 |

* Source: Rollins Environmental Services, Inc. 1988. Final Report for RES (TX) EDB Test Burn: Emission Test Results, Vol. 1 (Reference 23).

## Table 4-13

## DESIGN PARAMETERS FOR THE INCINERATOR SYSTEM AT ROLLINS ENVIRONMENTAL SERVICES, INC. (TEXAS)

| Physical Design Parameter | Value or Description |
|---|---|
| ROTARY KILN: | |
| Manufacturer | * |
| Height | NR |
| Inside diameter | 9.5 feet |
| Length | 32.8 feet |
| Volume | 2324 cubic feet |
| Width | NR |
| Materials of construction: | |
| Outer shell | 1.18 inch steel plate with 9 inch refractory lining. |
| Front wall | 0.59 inch steel plate with castable refractory and refractory brick lining. |
| LODDBY FURNACE: | |
| Manufacturer | * |
| Height | NR |
| Inside diameter | 6.25 feet |
| Length | 14 feet |
| Volume | 429 cubic feet |
| Width | NR |

## Table 4-13 (Continued)

## DESIGN PARAMETERS FOR THE INCINERATOR SYSTEM AT ROLLINS ENVIRONMENTAL SERVICES, INC. (TEXAS)

| Physical Design Parameter | Value or Description |
|---|---|
| AFTERBURNER: | |
| Manufacturer | * |
| Height | 13.5 FEET |
| Inside diameter | NR |
| Length | 49 FEET |
| Volume | 8300 cubic feet |
| Width | 12.5 FEET |
| Materials of construction: | |
| Outer shell | 13 inch refractory bricks supported fy stainless steel clips attacheed to steel beams. |
| Ceiling | 6 inch bricks |

* This equipment has been especially designed for RES(TX), Inc. and, therefore, does not carry model numbers.

NR - Not reported.

## TABLE 4-14

## CONCENTRATIONS OF WASTE CONSTITUENTS DETECTED IN THE UNTREATED OR TREATED WASTES - ORGANO-NITROGEN COMPOUND WASTES

| Waste Code | BDAT # | Waste Constituent | Treatment Test Detected In (#)* | Concentration In Untreated Waste (ppm)** | Concentration In Ash (ppm/[# of sample sets])** | Concentration In Scrubber Water (ppm/[# of sample sets])** |
|---|---|---|---|---|---|---|
| U003 | 1 | Acetonitrile | 3 | 0.68-2.7 | <0.1 [7] | <0.1 [7] |
| U009 | 3 | Acrylonitrile | 3 | 0.41-0.95 | <0.1 [7] | <0.1 [7] |
| U012 | 56 | Aniline | 4 | 1.2 | <5 [6] | <0.005 [6] |
| U169 | 126 | Nitrobenzene | 4 | 0.027-8.2 | <5 [6] | <0.005 [6] |
| U196 | 39 | Pyridine | 1 | <5 | <5 [3] | <0.005 [5], 0.061 [1] |

* - Treatment test # is indicated in Table 4-1.

** - Number in parenthesis indicates the number of sample sets the value was reported.

TABLE 4-15

DETECTION LIMITS FOR CONSTITUENTS IN THE ORGANO-NITROGEN COMPOUND WASTES
NOT QUANTIFIED ABOVE DETECTION LIMITS

| Waste Code | BOAT # | Constituent | Test No. * -> | Detection Limit (ppm) 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Incinerator Ash | | | | | | | | | | | | | | | | | |
| P101 | 30 | Ethyl cyanide (Propanenitrile) | | 0.1 | NA | NA | 100 | NA | NA | 100 | 0.5 | 0.1 | 30 | 0.1 | ** | NA | NA |
| U152 | 37 | Methacrylonitrile | | 0.2 | NA | NA | 10 | 10 | NA | 10 | 0.5 | 0.1 | 30 | 0.1 | ** | NA | 10 |
| U007 | 233 | Acrylamide | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| U091 | 93 | 3,3'-Dimethoxybenzidine | | 500 | NA | 0.702 | 10 | 500 | 400 | 1 | 1 | 0.42 | 1 | 0.702 | ** | NA | NA |
| U093 | 94 | p-Dimethylaminoazobenzene | | 10 | 0.23 | 0.702 | 5 | 10 | 7 | 0.5 | 2 | 0.84 | 2 | 0.702 | ** | 0.36 | 0.36 |
| U095 | 95 | 3,3'-Dimethylbenzidine | | 500 | 0.55 | 0.702 | NA | 500 | 400 | NA | NA | NA | NA | 0.702 | ** | 0.36 | 0.36 |
| U105 | 102 | 2,4-Dinitrotoluene | | 0.5 | 0.38 | 0.351 | 50 | 0.5 | 0.4 | 5 | 1 | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| U106 | 103 | 2,6-Dinitrotoluene | | 0.5 | 0.13 | 0.351 | 10 | 0.5 | 0.4 | 1 | 1 | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| U111 | 105 | Di-n-propylnitrosamine | | NA | NA | 0.351 | 5 | NA | NA | 0.5 | NA | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| U167 | 123 | 1-Naphthylamine | | 5 | 0.38 | 1.76 | 2 | 5 | 4 | 0.2 | 5 | 2.1 | 5 | 1.76 | ** | 0.36 | 0.36 |
| U168 | 124 | 2-Naphthylamine | | 5 | 0.87 | 1.76 | 2 | 5 | 4 | 0.2 | 5 | 2.1 | 5 | 1.76 | ** | 0.36 | 0.36 |
| P077 | 125 | p-Nitroaniline | | 2.5 | 3.4 | 1.76 | 10 | 2.5 | 2 | 1 | 5 | 2 | 5 | 1.76 | ** | 1.7 | 1.7 |
| U172 | 128 | n-Nitrosodi-n-butylamine | | 5 | 0.21 | 0.702 | 5 | 5 | 4 | 0.5 | NA | NA | NA | 0.702 | ** | 0.36 | 0.36 |
| U174 | 129 | n-Nitrosodiethylamine | | 5 | 0.18 | 0.351 | 10 | 5 | 4 | 1 | NA | NA | NA | 0.351 | ** | 0.36 | 0.36 |
| P082 | 130 | n-Nitrosodimethylamine | | 5 | 0.67 | 0.351 | 20 | 5 | 4 | 2 | 1 | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| U181 | 135 | 5-Nitro-o-toluidine | | 10 | 0.17 | 0.702 | NA | 20 | 7 | NA | 2 | 0.84 | 2 | 0.702 | ** | 0.36 | 0.36 |
| U179 | 133 | n-Nitrosopiperidine | | 10 | 0.19 | 0.351 | 10 | 20 | 7 | 1 | 1 | 0.42 | 1 | 0.351 | ** | 0.36 | 0.36 |
| U180 | 134 | n-Nitrosopyrrolidine | | 10 | 0.28 | 1.76 | 10 | 20 | 7 | 1 | 5 | 2.1 | 5 | 1.76 | ** | 0.36 | 0.36 |

* - Treatment test # is indicated in Table 4-1.
** - Incinerator ash samples were not collected for Test 12.
NA - Not Available

TABLE 4-15 (Continued)

DETECTION LIMITS FOR CONSTITUENTS IN THE ORGANO-NITROGEN COMPOUND WASTES
NOT QUANTIFIED ABOVE DETECTION LIMITS

| Waste Code | BDAT # | Constituent | Test No. * -> | Detection Limit (ppm) 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scrubber Water | | | | | | | | | | | | | | | | | |
| P101 | 30 | Ethyl cyanide (Propanenitrile) | | 0.0001 | NA | NA | 0.1 | NA | NA | 0.006 | 0.1 | 0.1 | 0.10 | 0.1 | 0.1 | 0.005 | 0.005 |
| U152 | 37 | Methacrylonitrile | | 0.0002 | NA | NA | 0.01 | 0.01 | NA | 0.0045 | 0.1 | 0.1 | 0.10 | 0.1 | NA | 0.005 | 0.005 |
| U007 | 233 | Acrylamide | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| U091 | 93 | 3,3'-Dimethoxybenzidine | | 10 | 0.008 | NA | 0.01 | 10 | 10 | 0.05 | NA | 0.01 | 0.01 | 0.0242 | 10 | NA | NA |
| U093 | 94 | p-Dimethylaminoazobenzene | | 0.2 | 0.003 | 0.2 | 0.005 | 0.04 | 0.2 | 0.01 | 0.02 | 0.02 | 0.02 | 0.0242 | 0.2 | 0.011 | 0.013 |
| U095 | 95 | 3,3'-Dimethylbenzidine | | 10 | NA | NA | NA | 10 | 10 | 0.01 | 0.01 | NA | NA | 0.0242 | 10 | 0.011 | 0.013 |
| U105 | 102 | 2,4-Dinitrotoluene | | 0.01 | 0.006 | 0.01 | 0.05 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.0121 | 0.01 | 0.011 | 0.013 |
| U106 | 103 | 2,6-Dinitrotoluene | | 0.01 | 0.002 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.0121 | 0.01 | 0.011 | 0.013 |
| U111 | 105 | Di-n-propylnitrosamine | | NA | NA | NA | 0.005 | NA | NA | 0.01 | NA | 0.01 | 0.01 | 0.0121 | NA | 0.011 | 0.013 |
| U167 | 123 | 1-Naphthylamine | | 0.1 | 0.006 | 0.1 | 0.002 | 0.1 | 0.1 | 0.01 | NA | 0.05 | 0.05 | 0.0605 | 0.1 | 0.011 | 0.013 |
| U168 | 124 | 2-Naphthylamine | | 0.1 | 0.013 | 0.1 | 0.002 | 0.1 | 0.1 | 0.01 | 0.05 | 0.05 | 0.05 | 0.0605 | 0.1 | 0.011 | 0.013 |
| P077 | 125 | p-Nitroaniline | | 0.05 | 0.052 | 0.05 | 0.01 | 0.05 | 0.05 | 0.05 | NA | 0.05 | 0.05 | 0.0605 | 0.05 | 0.056 | 0.063 |
| U172 | 128 | n-Nitrosodi-n-butylamine | | 0.1 | 0.003 | 0.1 | 0.005 | 0.1 | 0.1 | 0.01 | 0.01 | NA | NA | 0.0242 | 0.1 | 0.011 | 0.013 |
| U174 | 129 | n-Nitrosodiethylamine | | 0.1 | 0.003 | 0.1 | 0.01 | 0.1 | 0.1 | 0.01 | 0.02 | NA | NA | 0.0121 | 0.1 | 0.011 | 0.013 |
| P082 | 130 | n-Nitrosodimethylamine | | 0.1 | 0.011 | 0.1 | 0.02 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 | 0.01 | 0.0121 | 0.1 | 0.011 | 0.013 |
| U181 | 135 | 5-Nitro-o-toluidine | | 0.2 | 0.003 | 0.2 | NA | 0.2 | 0.2 | 0.05 | 0.01 | 0.02 | 0.02 | 0.0242 | 0.2 | 0.011 | 0.013 |
| U179 | 133 | n-Nitrosopiperidine | | 0.2 | 0.003 | 0.2 | 0.01 | 0.2 | 0.2 | 0.01 | 0.01 | 0.01 | 0.01 | 0.0121 | 0.2 | 0.011 | 0.013 |
| U180 | 134 | n-Nitrosopyrrolidine | | 0.2 | 0.004 | 0.2 | 0.01 | 0.2 | 0.2 | 0.01 | NA | 0.05 | 0.05 | 0.0605 | 0.2 | 0.011 | 0.013 |

* - Treatment test # is indicated in Table 4-1.
** - Incinerator ash samples were not collected for Test 12.
NA - Not Available

## 5.0 SELECTION OF REGULATED CONSTITUENTS

This section presents the methodology and rationale for selection of regulated constituents in miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, brominated organic wastes, organo-sulfur compound wastes, and organo-nitrogen compound wastes.

Due to the lack of characterization data for the U and P wastes, only the constituents for which the wastes were listed were considered in developing numerical treatment standards. However, many of these U and P waste constituents are not amenable to quantification in hazardous waste matrices using current analytical methods and, therefore, determining numerical treatment standards for these constituents would not be appropriate. For these U and P wastes, the Agency is instead specifying a method of treatment as the BDAT treatment standard. Table 2-4 summarizes the specific waste codes included in each treatability group and the amenability of each waste to quantification in hazardous waste matrices. Generally, if a U or P waste constituent is on the BDAT List, the Agency prefers to develop numerical treatment standards for that constituent. Exceptions to this general methodology are discussed in Section 6.0.

The Agency is proposing to specify a method of treatment as the BDAT treatment standard for all of the wastes included in the organo-sulfur compound treatability group since most of the waste constituents in this group are not amenable to quantification in hazardous waste matrices using current analytical methods. Therefore, constituents are not being selected for proposed regulation for the organo-sulfur compound treatability group.

The waste constituents selected for proposed regulation in each of the five treatability groups discussed above are summarized in Table 5-1.

## Table 5-1

## WASTES SELECTED FOR NUMERICAL TREATMENT STANDARDS
(page 1 of 2)

MISCELLANEOUS HALOGENATED ORGANIC WASTES

| Waste Code | Constituent |
|---|---|
| P024 | p-Chloroaniline |
| U017 | Benzal chloride |
| U024 | Bis-(2-Chloroethoxy)methane |
| U025 | Bis(2-chloroethyl)ether |
| U027 | Bis-(2-Chloroisopropyl)ether |
| U042 | 2-Chloroethyl vinyl ether |
| U043 | Vinyl chloride |
| U045 | Chloromethane |
| U047 | 2-Chloronaphthalene |
| U073 | 3,3'-Dichlorobenzidine |
| U075 | Dichlorodifluoromethane |
| U121 | Fluorotrichloromethane |
| U138 | Iodomethane |
| U158 | 4,4-Methylene-bis-(2-chloroaniline) |
| U192 | Pronamide |

WASTES OF A PHARMACEUTICAL NATURE

| Waste Code | Constituent |
|---|---|
| U141 | Isosafrole |
| U155 | Methapyrilene |
| U187 | Phenacetin |
| U203 | Safrole |

BROMINATED ORGANIC WASTES

| Waste Code | Constituent |
|---|---|
| U029 | Methyl bromide (Bromomethane) |
| U030 | 4-Bromophenyl phenyl ether |
| U066 | 1,2-Dibromo-3-chloropropane |
| U067 | Ethylene dibromide (1,2-Dibromomethane) |
| U068 | Dibromomethane |
| U225 | Bromoform (Tribromomethane) |

Table 5-1 (Continued)

WASTES SELECTED FOR NUMERICAL TREATMENT STANDARDS
(page 2 of 2)

ORGANO-SULFUR COMPOUND WASTES

No Constituents Selected for Proposed Regulation

ORGANO-NITROGEN COMPOUND WASTES

| Waste Code | Constituent |
|---|---|
| P077 | P-Nitroaniline |
| P082 | N-Nitrosodimethylamine |
| P101 | Ethyl Cyanide (Propanenitrile) |
| U003 | Acetonitrile |
| U007 | Acrylamide |
| U009 | Acrylonitrile |
| U012 | Aniline |
| U091 | 3,3'-Dimethoxybenzidine |
| U093 | p-Dimethylaminoazobenzene |
| U095 | 3,3'-Dimethylbenzidine |
| U105 | 2,4-Dinitrotoluene |
| U106 | 2,6-Dinitrotoluene |
| U111 | Di-n-propylnitrosamine |
| U152 | Methacrylonitrile |
| U167 | 1-Naphthylamine |
| U168 | 2-Naphthylamine |
| U169 | Nitrobenzene |
| U172 | N-Nitrosodi-n-butylamine |
| U174 | N-Nitrosodiethylamine |
| U181 | 5-Nitro-o-toluidine |
| U179 | N-Nitrosopiperidine |
| U180 | N-Nitrosopyrrolidine |
| U196 | Pyridine |

# 6.0 CALCULATION OF PROPOSED BDAT TREATMENT STANDARDS

The Agency bases numerical treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards account for analytical limitations in available treatment performance data and for variabilities related to treatment, sampling, and analytical techniques and procedures. This section presents the proposed treatment standards for the constituents selected for regulation in Section 5.0 using the available performance data from the BDAT treatment technologies.

## 6.1 Treatment Standards for Waste Constituents Which are Amenable to Quantification in Hazardous Waste Matrices

Treatment standards for U and P wastes which are amenable to quantification in hazardous waste matrices were calculated based on data compiled from the BDAT incineration database for incinerator ash and scrubber water residuals. Specifically, the Agency considered treatment performance data from the 14 incineration tests listed in Table 4-1. Alternate treatment standards for U and P wastewaters were calculated based on wastewater treatment data from EPA's Office of Water and EPA-conducted wastewater treatment tests. These data were not available in time for incorporation into this document; these data are included in the Wastewater Background Document (Reference 3) and in the administrative record for this rulemaking as discussed in Section 1.2.

For each waste code included in this document, the Agency first determined whether the waste constituents were detected in the untreated or treated wastes included in any of the 14 treatment tests. Treatment performance data for waste constituents in the miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, and organo-nitrogen compound wastes treatability groups that were detected in one or more of the 14 treatment tests, are included in Tables 4-2, 4-4, and 4-8, respectively. Detection limits achieved for waste constituents in the miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, and organo-nitrogen compound wastes treatability groups that were not quantified above detection limits in any of the 14 treatment tests, are summarized in Tables 4-3, 4-5, and 4-9, respectively.

For waste constituents that were detected in the untreated or treated waste, treatment standards were developed based on the highest detection limits in ash and scrubber water from those tests in which the waste constituent was detected. For waste constituents that were not detected in any of the untreated or treated wastes in the 14 treatment tests, the Agency developed treatment standards based on the highest detection limits in the ash and scrubber water in all of the 14 treatment tests.

Numerical treatment standards for waste constituents selected for regulation in Section 5.0 were calculated by multiplying the constituent detection limit in ash and scrubber water by an accuracy correction factor and by a variability factor. The following sections discuss these three components of the treatment standard calculation. These calculations are summarized in Tables 6-1 through 6-3.

### Detection Limits

Detection limits (presented in Section 4.0) for the ash and scrubber water residuals were used to calculate treatment standards for nonwastewater and wastewater forms of these wastes, respectively. In cases where the waste constituent was detected in more than one incineration test, the highest detection limits for the ash and scrubber water were used. For example, chloromethane (U045) was detected in two treatment tests (5 and 11) as indicated in Table 4-2. The highest detection limit for the ash samples was 2 ppm in Test 5. Therefore, 2 ppm was entered onto Table 6-1 for chloromethane nonwastewaters. For scrubber water, the highest detection limit was 0.01 ppm in Test 11. These data were onto Table 6-1 for chloromethane wastewaters.

For each waste constituent that was not detected in the untreated or treated wastes in any of the 14 tests, the highest detection limit reported for that constituent in the 14 treatment tests was used. For example, iodomethane (U138) was not detected in any of the 14 treatment tests. Detection limits for this constituent range from 0.002 ppm to 20 ppm as indicated in Table 4-3. Therefore, the detection limit of 20 ppm in Test 2 was entered onto Table 6-1 for iodomethane nonwastewaters. Similarly, a detection limit of 0.05 ppm from Tests 8, 9, 10, and 11 was entered onto Table 6-1 for iodomethane wastewaters.

Exceptions to this general methodology are noted in the treatability group subsections included at the end of Section 6.1.

Accuracy Correction Factors

The detection limits used to calculate treatment standards were corrected using matrix spike recovery data from the same test from which the detection limits were taken to account for analytical interferences associated with the chemical matrices of the samples. Detection limits were corrected for accuracy as follows:

- A matrix spike recovery was determined for each waste constituent. In cases where a matrix spike was not performed for a waste constituent from the treatment test for which the detection limit was used, the matrix spike recovery from a similar constituent from that treatment test was transferred to that constituent. The source of recovery data used for each constituent is indicated on Tables 6-1 through 6-4;
- An accuracy correction factor was determined for each of the above constituents by dividing 100 by the matrix spike recovery (percent) for that constituent; and
- Detection limits for each waste constituent were corrected by multiplying the reported concentration of each constituent by its corresponding accuracy correction factor.

Matrix spike recoveries that were used to adjust detection limits for each of the 14 incineration tests are included in Appendix C. Duplicate matrix spikes were performed for some waste constituents. If a duplicate matrix spike was performed for a constituent, the matrix spike recovery used for that constituent was the lower of the two values from the first matrix spike and the duplicate spike. Matrix spike recoveries of less than 20% are not acceptable and were not used to correct detection limits. Matrix spike recoveries greater than 100% were considered to be 100% for the purpose of this calculation so that the data were not adjusted to concentrations below the detection limits. In cases where the detection limit used was from more than one test, matrix spike recovery data from the test resulting in the highest accuracy correction factor was used. The test from which matrix spike recovery data were used is indicated in Tables 6-1 through 6-4.

### Variability Factors

The variability factor accounts for the variability inherent in treatment system performance, treatment residual collection, and analysis of the treated waste samples. Variability factors could not be calculated for waste constituents that were not detected in the incinerator ash or scrubber water residuals. In these cases, a variability factor of 2.8 was used to account for this inherent variability. In some cases, constituents were detected in the ash or scrubber water and a variability factor could be calculated. Variability factor calculations are included in Appendix D. The variability factors used to calculate the treatment standards for each waste constituent are included in Tables 6-1 through 6-4.

### 6.1.1 Miscellaneous Halogenated Organic Wastes

The calculated treatment standards for waste constituents included in the miscellaneous halogenated organic wastes group are presented in Table

6-1. With the exception of two constituents, the treatment standards were calculated as described above. The two exceptions are described below.

The detection limits for 2-chloroethyl vinyl ether (U042) in incinerator ash ranged from 0.01 to 200 ppm. The Agency determined that none of the detection limits were outliers. This broad range of detection limits suggest that analysis for this constituent is difficult in incinerator ash matrices due to matrix interferences. Treatment standards for U042 calculated based on a detection limit of 200 ppm for this constituent would be 970 ppm. The Agency does not believe that the general methodology is applicable in this case since the magnitude of this numerical treatment standard does not represent substantial treatment of this constituent by incineration. Therefore, the Agency is instead specifying incineration as the BDAT treatment standard for U042 nonwastewaters. Due to the problems in analyzing 2-chloroethyl vinyl ether in nonwastewaters, the Agency is also specifying a method of treatment as the BDAT treatment standard for U042 wastewaters: wet air oxidation followed by carbon adsorption, chemical oxidation followed by carbon adsorption or incineration.

Treatment performance data from incineration of benzal chloride in K015 in test 12 and p-dichlorobenzene in K019 in test 4 were used to calculate BDAT treatment standards for benzal chloride in U017 wastewaters and nonwastewaters, respectively, as discussed in Section 4.1. The calculated treatment standards for benzal chloride are included in Table 6-3. As a second regulatory option, the Agency is also proposing to specify a method of treatment as the BDAT treatment standard for U017 as discussed in Section 1.2. For K017 nonwastewaters, the Agency is proposing incineration as a method of treatment; for K017 wastewaters, the Agency is proposing wet air oxidation followed by carbon adsorption, chemical oxidation followed by carbon adsorption, or incineration as a method of treatment.

### 6.1.2 Wastes of a Pharmaceutical Nature

The calculated treatment standards for waste constituents included in the wastes of a pharmaceutical nature group are presented in Table 6-2. These treatment standards were all calculated as described above.

### 6.1.3 Brominated Organic Wastes

The Agency is aware of several facilities that currently incinerate bromine-containing wastes. The Agency recently incinerated ethylene dibromine wastes that were cancelled pesticides under FIFRA provisions as discussed in Section 4.4. Excess oxygen conditions had to be carefully controlled to reduce the amount of bromine gas and to increase the amount of hydrogen bromine gas generated by incineration. Hydrogen bromine is readily absorbed by the air pollution control devices (APCDs), while bromine is difficult to remove by APCDs. The Agency believes that control of the undesirable conversion of the bromine-containing waste to bromine gas affects the design and operation of the incineration systems significantly. For these reasons, the Agency did not believe that transfer of treatment performance data from incineration of non-brominated wastes (i.e., from any of the 14 tests listed in Table 4-1) was technically valid for the purpose of developing numerical treatment standards for brominated organic wastes.

Treatment performance data from the ethylene dibromide test burn were used to calculate BDAT treatment standards for nonwastewater and wastewater forms of these wastes. The calculated treatment standards for these wastes are included in Table 6-3.

### 6.1.4 Organo-sulfur Compound Wastes

Several of these waste constituents are not amenable to quantification in hazardous waste matrices using current analytical methods, precluding development of concentration-based standards. Therefore, the Agency is proposing to specify incineration as the BDAT treatment standard for nonwastewater forms and wet air oxidation followed by carbon adsorption as the BDAT treatment for wastewater forms of organo-sulfur compound wastes.

### 6.1.5 Organo-nitrogen Compound Wastes

The treatment standards for waste constituents included in the organo-nitrogen compound wastes treatability group are presented in Table 6-4. With the exception of three constituents, the treatment standards were calculated as described above. The three exceptions are described below.

The detection limits for 3-3'-Dimethoxybenzidine (U091) and 3,3'-Dimethylbenzidine (U095) in incinerator ash ranged from 0.42 to 500 ppm, and from 0.55 to 500 ppm, respectively. The Agency determined, based on engineering judgement, that none of the detection limits were outliers. These broad ranges of detection limits suggest that analysis of these constituents is difficult in incinerator ash matrices due to matrix interferences. A treatment standard for these constituents based on the highest detection limits would be 1,500 ppm for each constituent. The Agency does not believe that the general methodology is applicable in these cases since the magnitude of the numerical treatment standards does not represent substantial treatment of these constituents by incineration. Therefore, the Agency is instead specifying incineration as the BDAT treatment standard for U091 and U095 nonwastewaters. Due to the problems in analyzing 3,3'-dimethoxybenzidine and 3,3'-dimethylbenzidine in nonwastewaters, the Agency is also specifying a method of treatment as the BDAT treatment standard for U091 and U095 wastewaters: wet air oxidation followed by carbon adsorption, chemical oxidation followed by carbon adsorption, biological treatment followed by carbon adsorption, or incineration.

There were no detection limits available for acrylamide (U007) in incinerator ash or scrubber water for any of the 14 incineration tests and a concentration-based treatment standard could not be calculated. The Agency is specifying incineration as the BDAT treatment standard for U007 nonwastewaters and wet air oxidation followed by carbon adsorption as the BDAT treatment standard for U007 wastewaters.

## 6.2 Treatment Standards for Waste Constituents Which are Not Amenable to Quantification in Hazardous Waste Matrices Using Current Analytical Methods

The Agency is specifying incineration as the BDAT treatment standard for nonwastewater forms of waste constituents that are not amenable to quantification in hazardous waste matrices using current analytical methods. Wet air oxidation followed by carbon adsorption, chemical oxidation followed by carbon adsorption, and incineration are the BDAT treatment standard for wastewater forms of waste constituents that are not amenable to quantification in hazardous waste matrices using current analytical methods. In addition, biological treatment followed by carbon adsorption is also BDAT for waste constituents in the wastes of a pharmaceutical nature, organo-sulfur compound wastes, brominated organic wastes, and organo-nitrogen compound wastes treatability groups that are not amenable to quantification in hazardous waste matrices using current analytical methods.

TABLE 6-1

CALCULATION OF TREATMENT STANDARDS FOR MISCELLANEOUS HALOGENATED ORGANIC WASTES

| Waste Code | BDAT # | Constituent | Detection Status in Untreated or Treated Waste (Y or N) | Detection Limit (ppm) | Detection Limit Taken From Test #(s) * | Recovery** (%) | Recovery Data Transferred From (BDAT #/Test #)* | Accuracy Correction Factor | Corrected Detection Limit (ppm) | Variability Factor | Treatment Standard (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nonwastewater | | | | | | | | | | | |
| U045 | 15 | Chloromethane | Y | 2 | 5 | 136 | 24/5 | 1.00 | 2.000 | 2.8 | 5.6 |
| U075 | 21 | Dichlorodifluoromethane | Y | 2 | 4,5,7 | 78 | 24/4 | 1.28 | 2.560 | 4.04 | 10 |
| U138 | 32 | Iodomethane | N | 20 | 2 | 86 | 24/2 | 1.16 | 23.256 | 2.8 | 65 |
| U121 | 48 | Trichlorofluoromethane | N | 10 | 2 | 86 | 24/2 | 1.16 | 11.628 | 2.8 | 33 |
| U043 | 50 | Vinyl chloride | Y | 0.01 | 11 | 80 | 24/11 | 1.25 | 0.013 | 2.8 | 0.035 |
| U024 | 67 | Bis(2-chloroethoxy)methane | N | 2 | 4 | 78 | 24/4 | 1.28 | 2.564 | 2.8 | 7.2 |
| U025 | 68 | Bis(2-chloroethyl)ether | Y | 2 | 4 | 78 | 24/4 | 1.28 | 2.564 | 2.8 | 7.2 |
| U027 | 69 | Bis(2-chloroisopropyl)ether | N | 2 | 4 | 78 | 24/4 | 1.28 | 2.564 | 2.8 | 7.2 |
| P024 | 74 | p-Chloroaniline | N | 5 | 4,5,1 | 90 | 127/1 | 1.11 | 5.556 | 2.8 | 16 |
| U047 | 77 | 2-Chloronaphthalene | N | 2 | 4 | 110 | 52/4 | 1.00 | 2.000 | 2.8 | 5.6 |
| U073 | 89 | 3,3'-Dichlorobenzidine | Y | 1.76 | 11 | 30 | 52/11 | 3.33 | 5.867 | 2.8 | 16 |
| U158 | 120 | 4,4'-Methylenebis(2-chloroaniline) | N | 10 | 1,5 | 96 | 52/5 | 1.04 | 10.417 | 2.8 | 29 |
| U192 | 144 | Pronamide | Y | 0.33 | 13 | 69 | 144/13 | 1.45 | 0.478 | 2.8 | 1.5 |
| Wastewater | | | | | | | | | | | |
| U045 | 15 | Chloromethane | Y | 0.01 | 11 | 80 | 24/11 | 1.25 | 0.013 | 1.86 | 0.023 |
| U075 | 21 | Dichlorodifluoromethane | Y | 0.05 | 7 | 154 | 24/7 | 1.00 | 0.050 | 2.8 | 0.14 |
| U138 | 32 | Iodomethane | N | 0.05 | 8,9,10,11 | 60 | 24/9 | 1.67 | 0.083 | 2.8 | 0.23 |
| U121 | 48 | Trichlorofluoromethane | N | 0.047 | 7 | 154 | 24/7 | 1.00 | 0.047 | 2.8 | 0.13 |
| U043 | 50 | Vinyl chloride | Y | 0.01 | 11 | 80 | 24/11 | 1.25 | 0.013 | 2.65 | 0.033 |
| U024 | 67 | Bis(2-chloroethoxy)methane | N | 0.013 | 14 | 57 | 24/14 | 1.75 | 0.023 | 2.8 | 0.064 |
| U025 | 68 | Bis(2-chloroethyl)ether | Y | 0.002 | 4 | 44 | 24/4 | 2.27 | 0.005 | 2.8 | 0.013 |
| U027 | 69 | Bis(2-chloroisopropyl)ether | N | 0.013 | 14 | 57 | 24/14 | 1.75 | 0.023 | 2.8 | 0.064 |
| P024 | 74 | p-Chloroaniline | N | 0.1 | 1,3,6,12 | 100 | 127/12 | 1.00 | 0.100 | 2.8 | 0.28 |
| U047 | 77 | 2-Chloronaphthalene | N | 0.013 | 14 | 50 | 52/14 | 2.00 | 0.026 | 2.8 | 0.073 |
| U073 | 89 | 3,3'-Dichlorobenzidine | Y | 0.0605 | 11 | 78 | 52/11 | 1.28 | 0.078 | 2.8 | 0.22 |
| U158 | 120 | 4,4'-Methylenebis(2-chloroaniline) | N | 0.2 | 1,3,6,12 | 76 | 52/12 | 1.32 | 0.263 | 2.8 | 0.74 |
| U192 | 144 | Pronamide | Y | 0.011 | 13 | 79 | 144/13 | 1.27 | 0.014 | 2.8 | 0.039 |

TABLE 6-1 (Continued)

CALCULATION OF TREATMENT STANDARDS FOR MISCELLANEOUS HALOGENATED ORGANIC WASTES

| Regulated Constituent (SW-846 Method Number) | Constituents from which Treatment performance Data were Transferred | Arithmatic Average of Corrected Treatment Performance Values (ppm) | Variability Factor (VF) | Treatment Standard (Average x VF) (ppm) |
|---|---|---|---|---|
| NONWASTEWATERS | | | | |
| Semivolatile Organics (8270) | | | | |
| U017 Benzal chloride | p-Dichlorobenzene | 2.22 | 2.8 | 6.2 |
| WASTEWATERS | | | | |
| Semivolatile Organics (8270) | | | | |
| U017 Benzal chloride | Benzal chloride | 0.138 | 2.02 | 0.28 |

TABLE 6-2

CALCULATION OF TREATMENT STANDARDS FOR WASTES OF A PHARMACEUTICAL NATURE

| Waste Code | BDAT # | Constituent | Detection Status in Untreated or Treated Waste (Y or N) | Detection Limit (ppm) | Detection Limit Taken From Test #(s) * | Recovery (%) | Recovery Data Transferred From (BDAT #/Test #)* | Accuracy Correction Factor | Corrected Detection Limit (ppm) | Variability Factor | Treatment Standard (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nonwastewater | | | | | | | | | | | |
| U141 | 117 | Isosafrole | Y | 0.36 | 14 | 39 | 117/14 | 2.56 | 0.923 | 2.8 | 2.6 |
| U155 | 118 | Methapyrilene | N | 0.36 | 13,14 | 69 | 144/13 | 1.45 | 2.464 | 2.8 | 6.9 |
| U187 | 140 | Phenacetin | N | 5 | 1,5 | 90 | 127/1 | 1.11 | 5.556 | 2.8 | 16 |
| U203 | 147 | Safrole | N | 5 | 1,5,8,10 | 64 | 76/10 | 1.56 | 7.813 | 2.8 | 22 |
| Wastewater | | | | | | | | | | | |
| U141 | 117 | Isosafrole | Y | 0.013 | 14 | 48 | 117/14 | 2.08 | 0.027 | 2.8 | 0.076 |
| U155 | 118 | Methapyrilene | N | 0.013 | 14 | 25 | 144/14 | 4.00 | 0.052 | 2.8 | 0.15 |
| U187 | 140 | Phenacetin | N | 0.1 | 1,3,5,6 | 77 | 127/5 | 1.30 | 0.130 | 2.8 | 0.36 |
| U203 | 147 | Safrole | N | 0.1 | 1,5,6,12 | 22 | 76/1 | 4.55 | 0.455 | 2.8 | 1.3 |

* Treatment test indicated in Table 4-1.

## TABLE 6-3

## CALCULATION OF TREATMENT STANDARDS FOR BROMINATED ORGANIC WASTES

| Regulated Constituent (SW-846 Method Number) | Constituent from which Treatment Performance Data were Transferred | Arithmetic Average of Corrected Treatment Performance Values (ppm) | Variability Factor (VF) | Treatment Standard (Average x VF) (ppm) |
|---|---|---|---|---|
| **NONWASTEWATER** | | | | |
| Volatile Organics (8240): | | | | |
| U029 Methyl bromide | Ethylene dibromide | 5.41 | 2.8 | 15 |
| U066 1,2-Dibromo-3-chloropropane | Ethylene dibromide | 5.41 | 2.8 | 15 |
| U067 Ethylene dibromide (1,2-Dibromomethane) | Ethylene dibromide | 5.41 | 2.8 | 15 |
| U068 Dibromomethane | Ethylene dibromide | 5.41 | 2.8 | 15 |
| U225 Bromoform (Tribromomethane) | Ethylene dibromide | 5.41 | 2.8 | 15 |
| Semivolatile Organics (8270): | | | | |
| U030 4-Bromophenyl phenyl ether | Ethylene dibromide | 5.41 | 2.8 | 15 |
| **WASTEWATER** | | | | |
| Volatile Organics (8240): | | | | |
| U029 Methyl bromide | Ethylene dibromide | 5.68 | 2.8 | 16 |
| U066 1,2-Dibromo-3-chloropropane | Ethylene dibromide | 5.68 | 2.8 | 16 |
| U067 Ethylene dibromide (1,2-Dibromomethane) | Ethylene dibromide | 5.68 | 2.8 | 16 |
| U068 Dibromomethane | Ethylene dibromide | 5.68 | 2.8 | 16 |
| U225 Bromoform (Tribromomethane) | Ethylene dibromide | 5.68 | 2.8 | 16 |
| Semivolatile Organics (8270): | | | | |
| U030 4-Bromophenyl phenyl ether | Ethylene dibromide | 5.68 | 2.8 | 16 |

TABLE 6-4

CALCULATION OF TREATMENT STANDARDS FOR ORGANO-NITROGEN COMPOUND WASTES (page 1 of 2)

| Waste Code | BDAT # | Constituent | Detection Status in Untreated or Treated Waste (Y or N) | Detection Limit (ppm) | Detection Limit Taken From Test #(s) * | Recovery (%) | Recovery Data Transferred From (BDAT #/Test #)* | Accuracy Correction Factor | Corrected Detection Limit (ppm) | Variability Factor | Treatment Standard (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nonwastewater | | | | | | | | | | | |
| P077 | 125 | p-Nitroaniline | N | 10 | 4 | 107 | 102/4 | 1.00 | 10.000 | 2.8 | 28 |
| P082 | 130 | n-Nitrosodimethylamine | N | 20 | 4 | 120 | 105/4 | 1.00 | 20.000 | 2.8 | 56 |
| P101 | 30 | Ethyl cyanide (Propane nitrile) | N | 100 | 4,7 | 78 | 24/4 | 1.28 | 128.205 | 2.8 | 360 |
| U003 | 1 | Acetonitrile | Y | 0.1 | 3 | 79 | 1/3 | 1.27 | 0.127 | 2.8 | 0.35 |
| U009 | 3 | Acrylonitrile | Y | 0.1 | 3 | 108 | 3/3 | 1.00 | 0.100 | 2.8 | 0.28 |
| U012 | 56 | Aniline | Y | 5 | 4 | 97 | 127/4 | 1.03 | 5.155 | 2.8 | 14 |
| U093 | 94 | p-Dimethylaminoazobenzene | N | 10 | 1,5 | 96 | 52/5 | 1.04 | 10.417 | 2.8 | 29 |
| U105 | 102 | 2,4-Dinitrotoluene | N | 50 | 4 | 107 | 102/4 | 1.00 | 50.000 | 2.8 | 140 |
| U106 | 103 | 2,6-Dinitrotoluene | N | 10 | 4 | 107 | 102/4 | 1.00 | 10.000 | 2.8 | 28 |
| U111 | 105 | Di-n-propylnitrosamine | N | 5 | 4 | 120 | 105/4 | 1.00 | 5.000 | 2.8 | 14 |
| U152 | 37 | Methacrylonitrile | N | 30 | 10 | 126 | 24/10 | 1.00 | 30.000 | 2.8 | 84 |
| U167 | 123 | 1-Naphthylamine | N | 5 | 1,5,8,10 | 91 | 52/8 | 1.10 | 5.495 | 2.8 | 15 |
| U168 | 124 | 2-Naphthylamine | N | 5 | 1,5,8,10 | 91 | 52/8 | 1.10 | 5.495 | 2.8 | 15 |
| U169 | 126 | Nitrobenzene | Y | 5 | 4 | 97 | 127/4 | 1.03 | 5.155 | 2.8 | 14 |
| U172 | 128 | n-Nitrosodi-n-butylamine | N | 5 | 1,4,5 | 26 | 105/5 | 3.85 | 19.231 | 2.8 | 54 |
| U174 | 129 | n-Nitrosodiethylamine | N | 10 | 4 | 120 | 105/4 | 1.00 | 10.000 | 2.8 | 28 |
| U179 | 133 | n-Nitrosopiperidine | N | 20 | 5 | 26 | 105/5 | 3.85 | 76.923 | 2.8 | 220 |
| U180 | 134 | n-Nitrosopyrrolidine | N | 20 | 5 | 26 | 105/5 | 3.85 | 76.923 | 2.8 | 220 |
| U181 | 135 | 5-Nitro-o-toluidine | N | 20 | 5 | 118 | 102/5 | 1.00 | 20.000 | 2.8 | 56 |
| U196 | 39 | Pyridine | Y | 5 | 1 | 88 | 4/1 | 1.14 | 5.682 | 2.8 | 16 |

* Treatment test indicated in Table 4-1.

(continued)

TABLE 6-4 (continued)

CALCULATION OF TREATMENT STANDARDS FOR ORGANO-NITROGEN COMPOUND WASTES (page 1 of 2)

| Waste Code | BDAT # | Constituent | Detection Status in Untreated or Treated Waste (Y or N) | Detection Limit (ppm) | Detection Limit Taken From Test #(s) * | Recovery (%) | Recovery Data Transferred From (BDAT #/Test #)* | Accuracy Correction Factor | Corrected Detection Limit (ppm) | Variability Factor | Treatment Standard (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wastewater | | | | | | | | | | | |
| P077 | 125 | p-Nitroaniline | N | 0.063 | 14 | 71 | 102/14 | 1.41 | 0.089 | 2.8 | 0.25 |
| P082 | 130 | n-Nitrosodimethylamine | N | 0.1 | 1,3,5,6,12 | 42 | 105/5 | 2.38 | 0.238 | 2.8 | 0.67 |
| P101 | 30 | Ethyl cyanide (Propanenitrile) | N | 0.1 | 4,8,9,10,11,12 | 44 | 24/4 | 2.27 | 0.227 | 2.8 | 0.64 |
| U003 | 1 | Acetonitrile | Y | 0.1 | 3 | 66 | 1/3 | 1.52 | 0.152 | 2.8 | 0.42 |
| U009 | 3 | Acrylonitrile | Y | 0.1 | 3 | 44 | 3/3 | 2.27 | 0.227 | 2.8 | 0.64 |
| U012 | 56 | Aniline | Y | 0.005 | 4 | 43 | 127/4 | 2.33 | 0.012 | 2.8 | 0.033 |
| U093 | 94 | p-Dimethylaminoazobenzene | N | 0.2 | 1,3,6,12 | 76 | 52/12 | 1.32 | 0.263 | 2.8 | 0.74 |
| U105 | 102 | 2,4-Dinitrotoluene | N | 0.05 | 4 | 84 | 102/4 | 1.19 | 0.060 | 2.8 | 0.17 |
| U106 | 103 | 2,6-Dinitrotoluene | N | 0.013 | 14 | 71 | 102/14 | 1.41 | 0.018 | 2.8 | 0.051 |
| U111 | 105 | Di-n-propylnitrosamine | N | 0.013 | 14 | 56 | 105/14 | 1.79 | 0.023 | 2.8 | 0.065 |
| U152 | 37 | Methacrylonitrile | N | 0.1 | 8,9,10,11 | 60 | 24/9 | 1.67 | 0.167 | 2.8 | 0.47 |
| U167 | 123 | 1-Naphthylamine | N | 0.1 | 1,3,5,6,12 | 76 | 52/12 | 1.32 | 0.132 | 2.8 | 0.37 |
| U168 | 124 | 2-Naphthylamine | N | 0.1 | 1,3,5,6,12 | 76 | 52/12 | 1.32 | 0.658 | 2.8 | 1.8 |
| U169 | 126 | Nitrobenzene | Y | 0.005 | 4 | 43 | 127/4 | 2.33 | 0.012 | 2.8 | 0.033 |
| U172 | 128 | n-Nitrosodi-n-butylamine | N | 0.1 | 1,3,5,6,12 | 42 | 105/5 | 2.38 | 0.238 | 2.8 | 0.67 |
| U174 | 129 | n-Nitrosodiethylamine | N | 0.1 | 1,3,5,6,12 | 42 | 105/5 | 2.38 | 0.238 | 2.8 | 0.67 |
| U179 | 133 | n-Nitrosopiperidine | N | 0.2 | 1,3,5,6,12 | 42 | 105/5 | 2.38 | 0.476 | 2.8 | 1.3 |
| U180 | 134 | n-Nitrosopyrrolidine | N | 0.2 | 1,3,5,6,12 | 42 | 105/5 | 2.38 | 0.476 | 2.8 | 1.3 |
| U181 | 135 | 5-Nitro-o-toluidine | N | 0.2 | 1,3,5,6,12 | 25 | 102/12 | 4.00 | 0.800 | 2.8 | 2.2 |
| U196 | 39 | Pyridine | Y | 0.005 | 1 | 92 | 4/1 | 1.09 | 0.005 | 5.72 | 0.031 |

* Treatment test indicated in Table 4-1.

## 7.0 ACKNOWLEDGEMENTS

This document was prepared for the U.S. Environmental Protection Agency, Office of Solid Waste, by Radian Corporation under Contract No. 68-W9-0072. This document was prepared under the direction of Mr. James Berlow, Chief, Waste Treatment Branch; Mr. Larry Rosengrant, Acting Section Head, Treatment Technology Section; and Mr. Jerry Vorbach, Project Officer. Ms. Lisa Jones served as the project manager for miscellaneous halogenated organic wastes, wastes of a pharmaceutical nature, brominated organic wastes, organo-sulfur compound wastes, and organo-nitrogen compound wastes regulatory development. Steve Silverman and Nandan Kenkeremeth served as EPA legal advisors.

The following personnel from Radian Corporation were involved in preparing this document: Mr. John Williams, Program Manager; Ms. Lori Stoll, Project Director; and the Radian engineering team, Ms. Debra Falatko and Ms. Wendy Rovansek.

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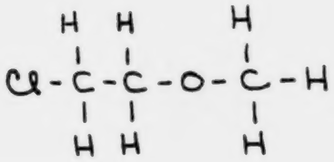
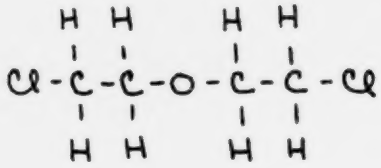
# Appendix A

## CHEMICAL STRUCTURES OF WASTE CONSTITUENTS INCLUDED IN THIS DOCUMENT

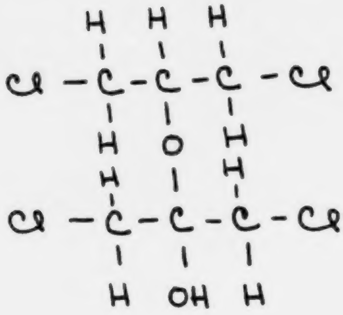
# Miscellaneous Halogenated Organics
(analyzable)



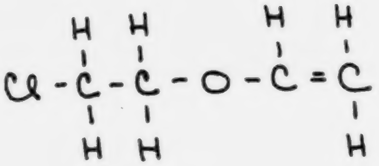
U024 Bis-(2-chloroethoxy) methane



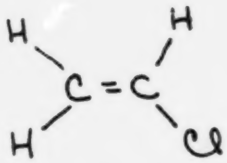
U025 Dichloroethyl ether



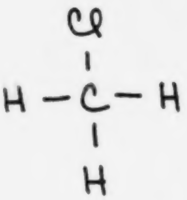
U027 Bis-(2-chloroisopropyl) ether



U042 2-Chloroethyl vinyl ether

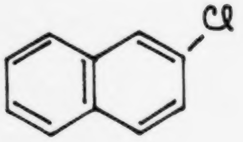


U043 Vinyl chloride

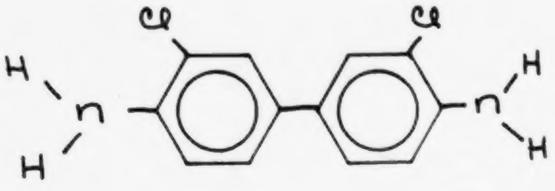


U045 Chloromethane

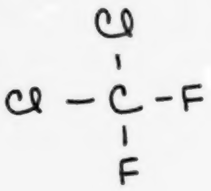
# Miscellaneous Halogenated Organics
## (analyzable)



U047 2-Chloronaphthalene

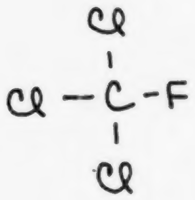


U073 3,3-Dichlorobenzidine



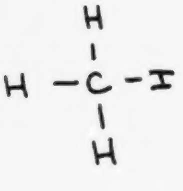
$$\begin{array}{c} \mathrm{Cl} \\ | \\ \mathrm{Cl}-\mathrm{C}-\mathrm{F} \\ | \\ \mathrm{F} \end{array}$$

U075 Dichlorodifluoromethane



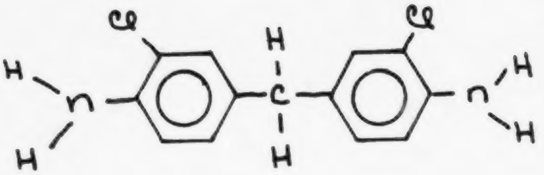
$$\begin{array}{c} \mathrm{Cl} \\ | \\ \mathrm{Cl}-\mathrm{C}-\mathrm{F} \\ | \\ \mathrm{Cl} \end{array}$$

U121 Fluorotrichloromethane



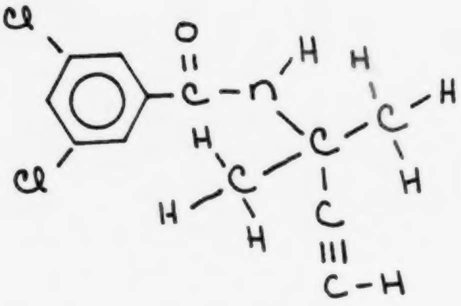
$$\begin{array}{c} \mathrm{H} \\ | \\ \mathrm{H}-\mathrm{C}-\mathrm{I} \\ | \\ \mathrm{H} \end{array}$$

U138 Iodomethane

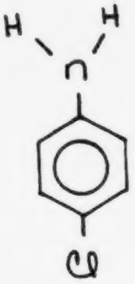


U158 4,4 Methylene-bis-(2-chloroaniline)

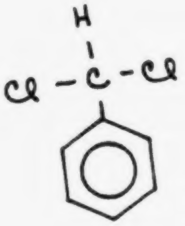
# Miscellaneous Halogenated Organics
(analyzable)



U192 Pronamide

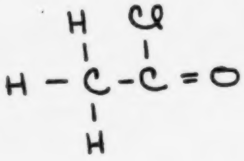


P024 p-Chloroaniline

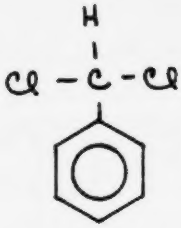


U017 Benzal chloride

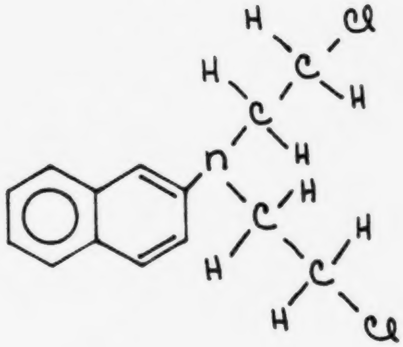
# Miscellaneous Halogenated Organics
(not Analyzable)



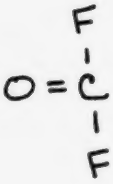
U006 acetyl chloride



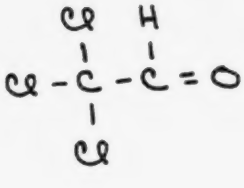
U017 Benzal chloride



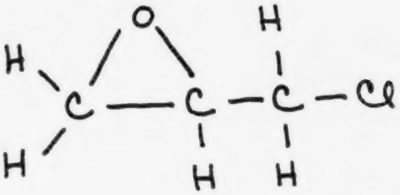
U026 Chloronaphazine



U033 Carbonyl fluoride

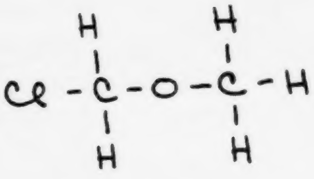


U034 Trichlorocetaldehyde

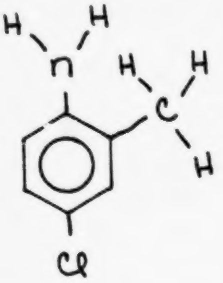


U041 Epichlorohydrin

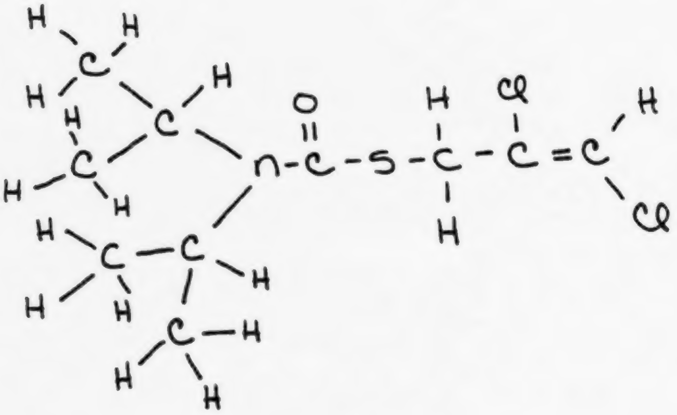
# Miscellaneous Halogenated Organics
(not Analyzable)



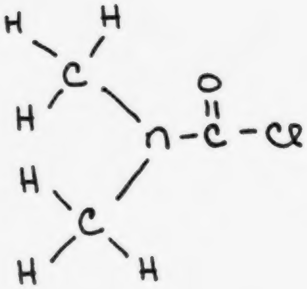
U046 Chloromethyl methyl ether



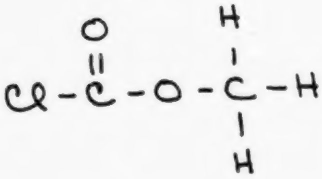
U049 4-Chloro-o-toluidine hydrochloride



U062 Diallate

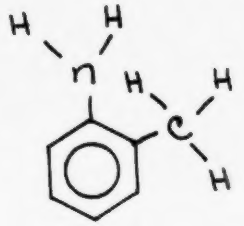


U097 Dimethylcarbonyl chloride

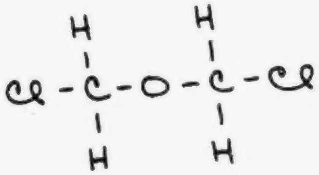


U156 Methyl chlorocarbonate

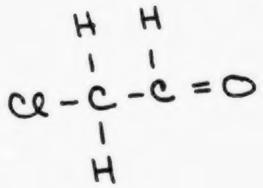
# Miscellaneous Halogenated Organics
(not analyzable)



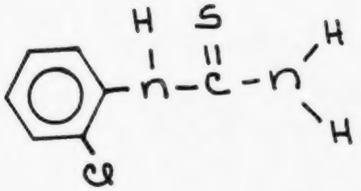
U222 o-Toluidine
hydrochloride



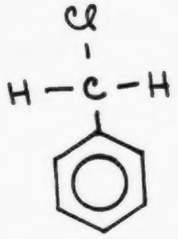
P016 bis-(chloromethyl) ether



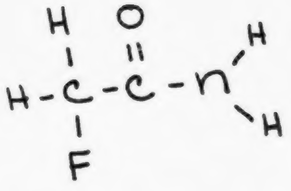
P023 Chloroacetaldehyde



P026 1-(o-Chlorophenyl)
thiourea

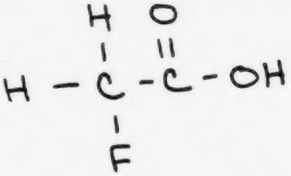


P028 Benzyl chloride



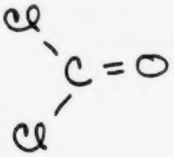
P057 2-Fluoroacetamide

# Miscellaneous Halogenated Organics
# (not Analyzable)

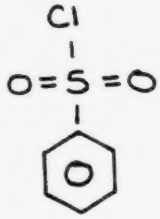


$$\mathrm{H-\overset{H}{\underset{F}{C}}-\overset{O}{\overset{\|}{C}}-OH}$$

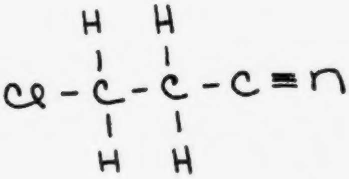
P058 Fluoroacetic acid



P095 Phosgene

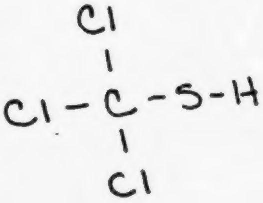


U020 Benzenesulfonyl chloride



$$\mathrm{Cl-\overset{H}{\underset{H}{C}}-\overset{H}{\underset{H}{C}}-C\equiv N}$$

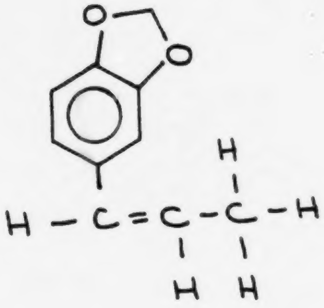
P027 3-Chloropropionitrile



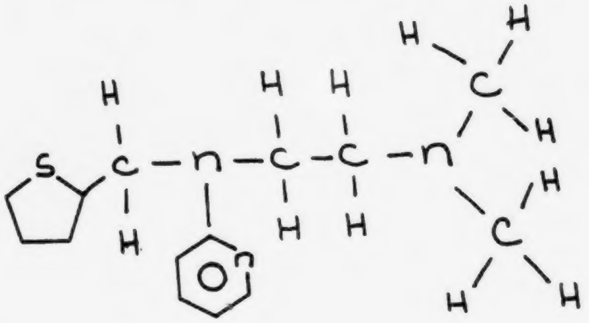
$$\mathrm{Cl-\overset{Cl}{\underset{Cl}{C}}-S-H}$$

P118 Trichloromethanthiol

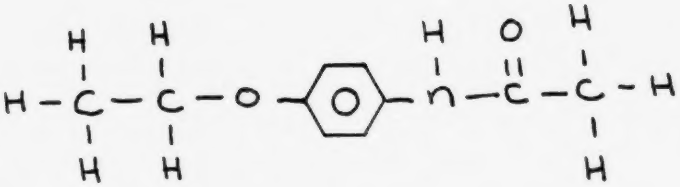
# Wastes of a Pharmaceutical Nature
(analyzable)



U141 Isosafrole

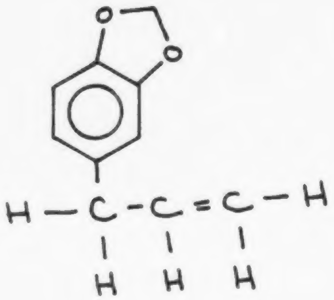


U155 methapyrilene



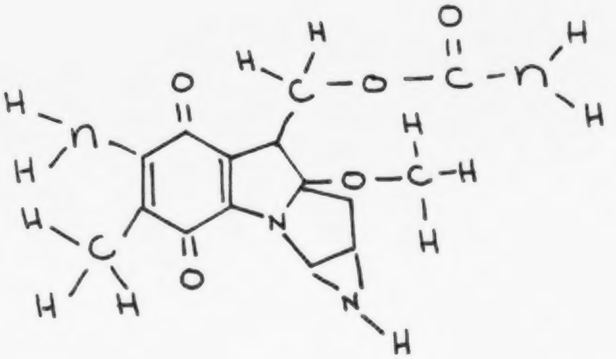
U187 Phenacetin

# Wastes of a Pharmaceutical Nature
(analyzable)

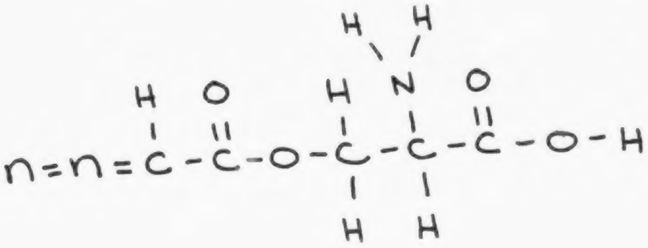


U203 Safrole

# Wastes of a Pharmaceutical Nature (not Analyzable)

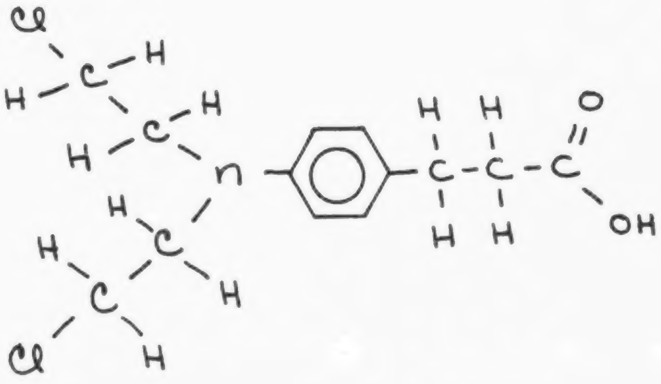


U010 Mitomycin C



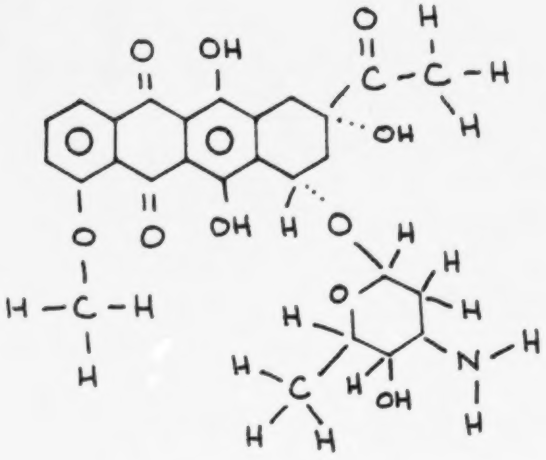
$$N{=}N{=}CH{-}C({=}O){-}O{-}CH_2{-}CH(NH_2){-}C({=}O){-}O{-}H$$

U015 azaserine

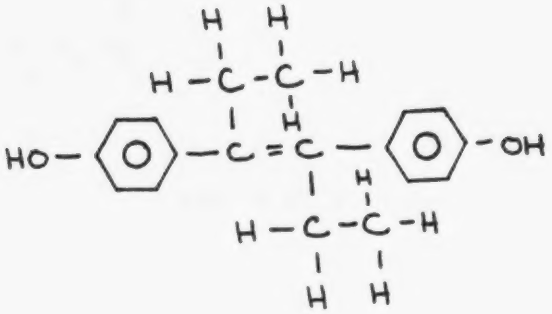


U035 Chlorambucil

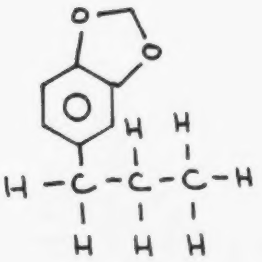
# Wastes of a Pharmaceutical Nature
# (not analyzable)



U059 Daunomucin



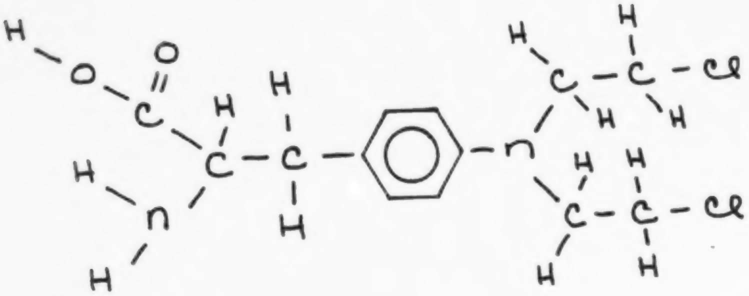
U089 Diethylstilbestrol



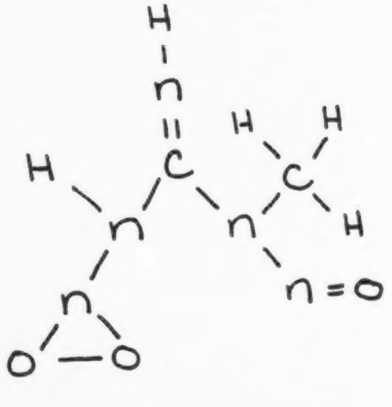
U090 Dihydrosafrole

# Wastes of a Pharmaceutical Nature
(not Analyzable)

U143 Lasiocarpine

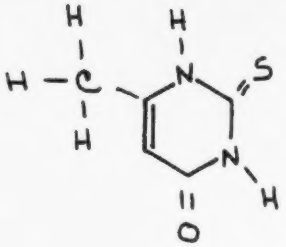


U150 Melphalan

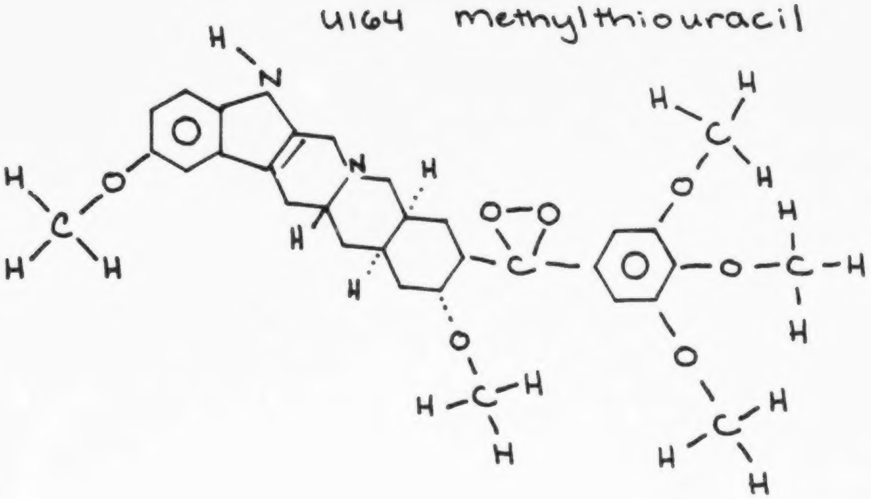


U163 n-methyl-, n-nitro-, n-nitrosoguanidine

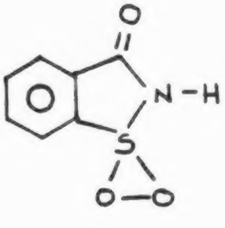
# Wastes of a Pharmaceutical Nature
(not analyzable)



U164 Methylthiouracil

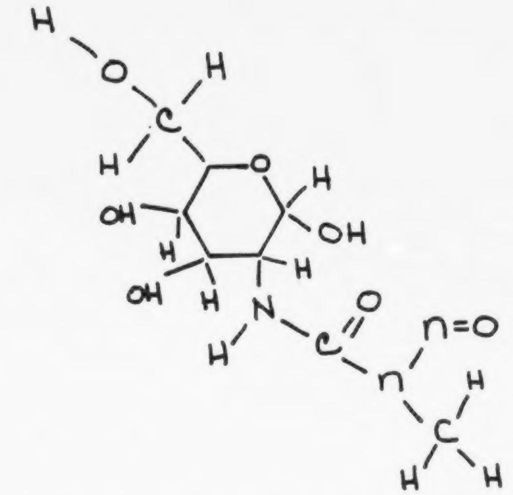


U200 Resperpine

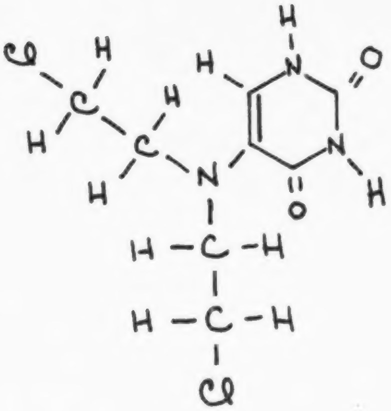


U202 Saccharin and Salts

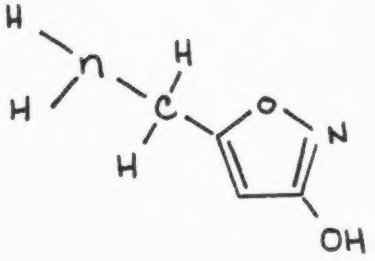
# Wastes of a Pharmaceutical Nature
(not Analyzable)



U206 Streptozotocin

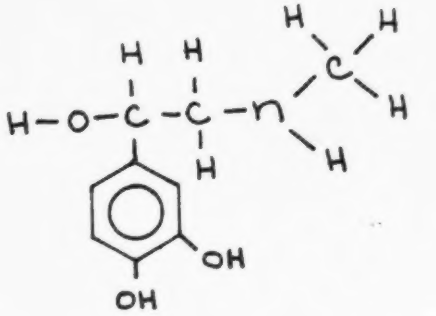


U237 Uracil mustard

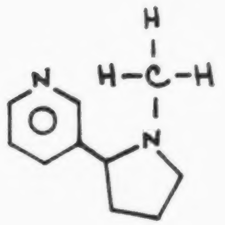


P007 5-aminoethyl, 3-isoxazolol

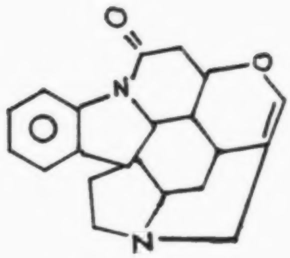
# Wastes of a Pharmaceutical Nature
# (not analyzable)



P042 Epinephrine

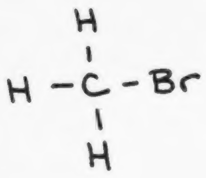


P075 Nicotine and Salts



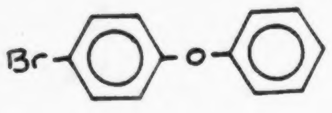
P108 Styrchnine and Salts

# Brominated Organics
# (analyzable)

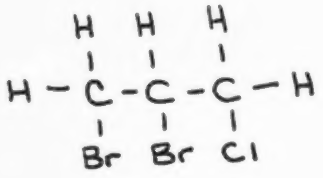


$$\begin{array}{ccccc} & & H & & \\ & & | & & \\ H & - & C & - & Br \\ & & | & & \\ & & H & & \end{array}$$

U029 methyl bromide

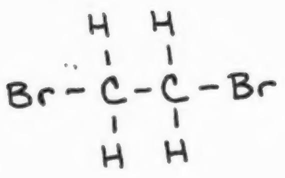


U030 4-Bromophenyl phenylether



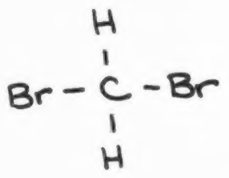
$$\begin{array}{ccccccccc} & & H & & H & & H & & \\ & & | & & | & & | & & \\ H & - & C & - & C & - & C & - & H \\ & & | & & | & & | & & \\ & & Br & & Br & & Cl & & \end{array}$$

U066 1,2-Dibromo-3-chloropropane



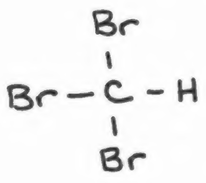
$$\begin{array}{ccccccc} & & H & & H & & \\ & & | & & | & & \\ Br & - & C & - & C & - & Br \\ & & | & & | & & \\ & & H & & H & & \end{array}$$

U067 Ethylene dibromide



$$\begin{array}{ccccc} & & H & & \\ & & | & & \\ Br & - & C & - & Br \\ & & | & & \\ & & H & & \end{array}$$

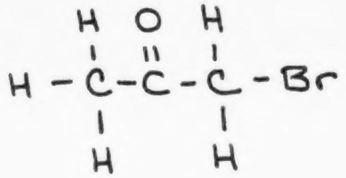
U068 Dibromomethane



$$\begin{array}{ccccc} & & Br & & \\ & & | & & \\ Br & - & C & - & H \\ & & | & & \\ & & Br & & \end{array}$$

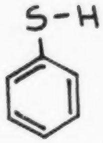
U225 Bromoform

# Brominated Organics
(not analyzable)



P017 Bromoacetone

# Organosulfur
(analyzable)

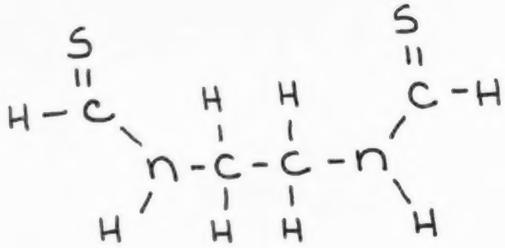


P014 Thiophenol

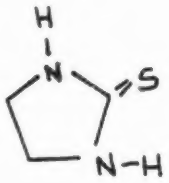
$S=C=S$

P022 Carbon disulfide

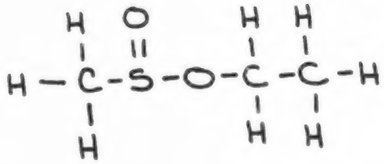
# Organosulfur
(not analyzable)



U114 Ethylene bis-dithiocarbamic acid

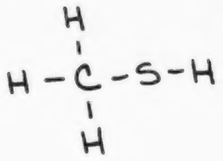


U116 Ethylene thiourea

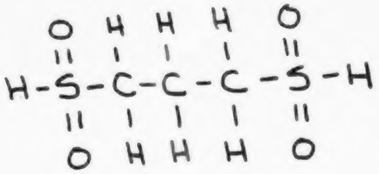


U119 Ethyl methane sulfonate

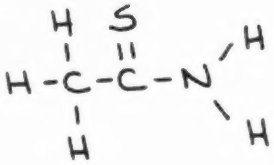
# Organosulfur
(not analyzable)



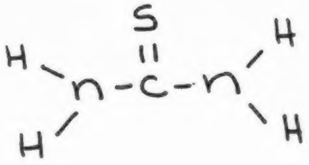
U153 methanethiol



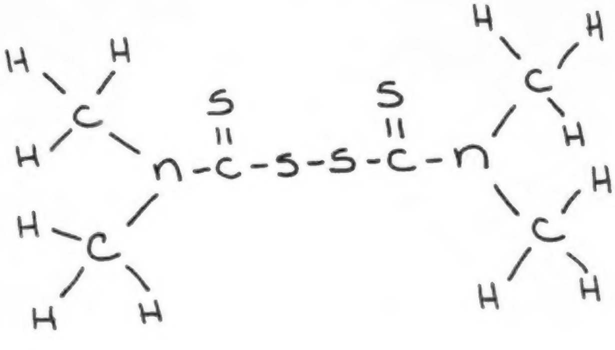
U193 1,3-Propane sulfone



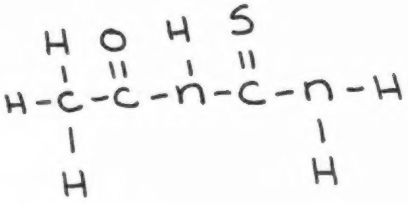
U218 Thiocetamide



U219 Thiourea

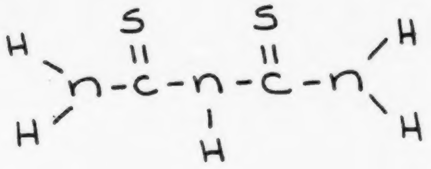


U244 Thiram



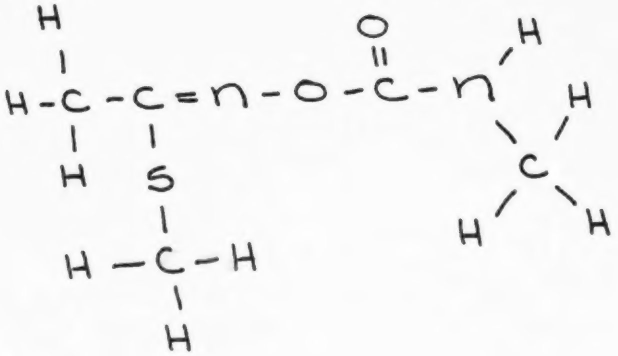
P002 1-Acetyl, 2-thiourea

# Organosulfur
(not analyzable)

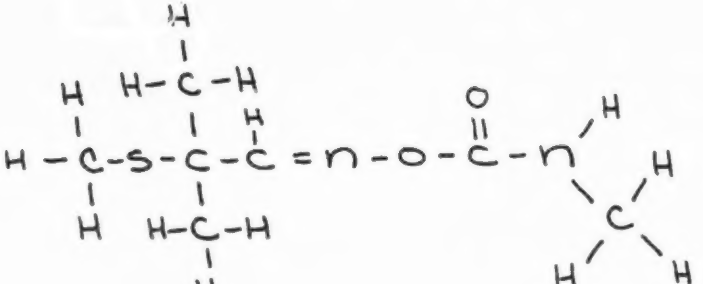


P045 Thiofanox

P049 2,4-Dithiobiuret

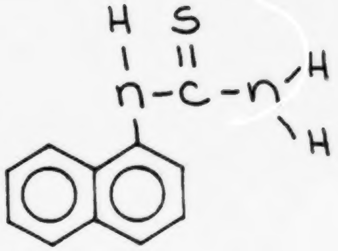


P066 methomyl

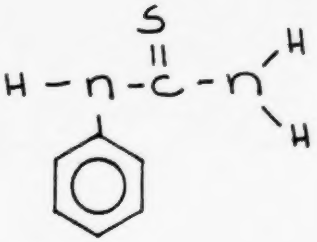


P070 aldicarb

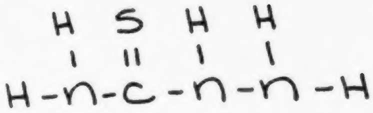
## Organosulfur
## (not analyzable)



P072 1-Naphthyl-2-thiourea



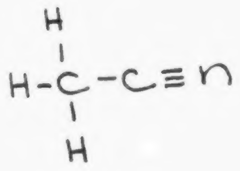
P093 N-Phenylthiourea



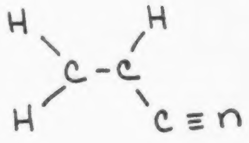
$$H-\overset{\overset{H}{|}}{N}-\overset{\overset{S}{\|}}{C}-\overset{\overset{H}{|}}{N}-\overset{\overset{H}{|}}{N}-H$$

P116 Thiosemicarbazide

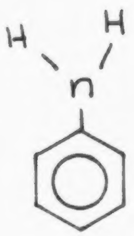
# Nitrogen Functional Groups
(Analyzable)



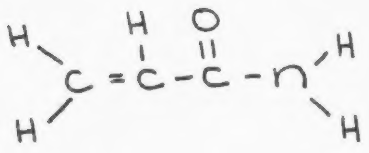
U003 Acetonitrile



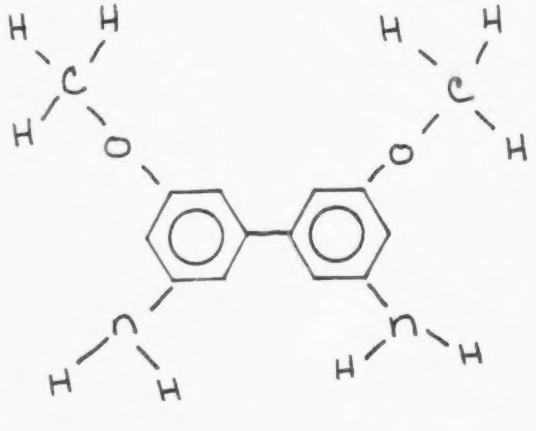
U009 acrylonitrile



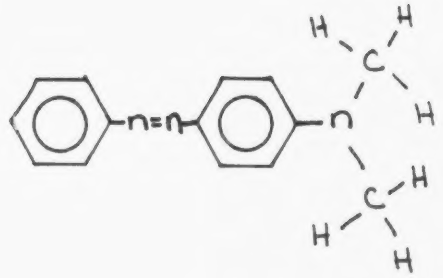
U012 aniline



U007 acrylamide

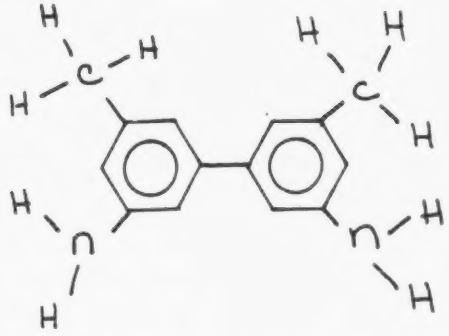


U091 3,3-Dimethoxybenzidine

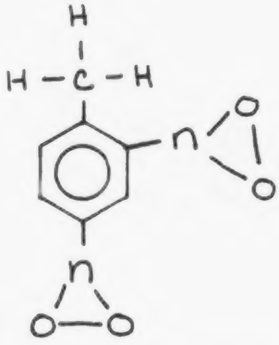


U093 P-Dimethylamino-azobenzidine

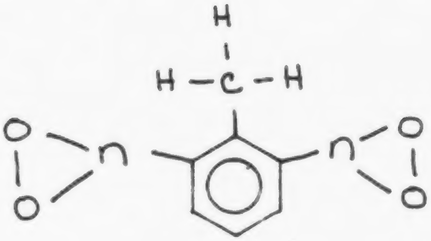
# Nitrogen Functional Groups
(analyzable)



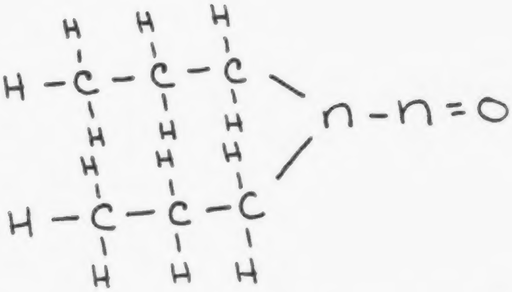
U095 3,3-Dimethylbenzidine



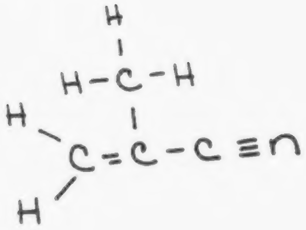
U105 2,4-Dinitrotoluene



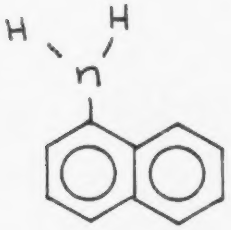
U106 2,6-Dinitrotoluene



U111 Di-n-propylnitrosamine

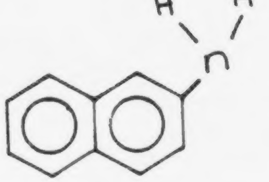


U152 methacrylonitrile

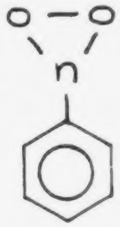


U167 1-naphthylamine

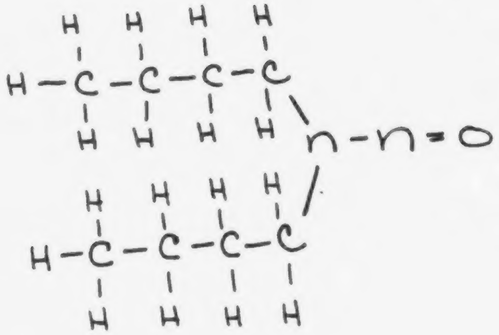
# Nitrogen Functional Groups
(analyzable)



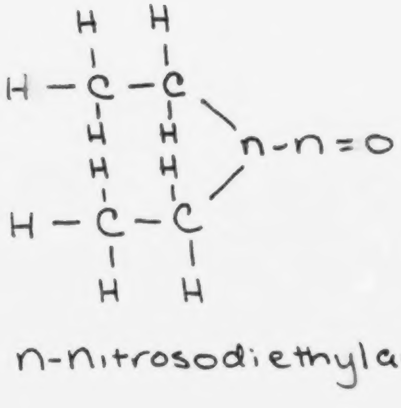
U168 2-Naphthylamine



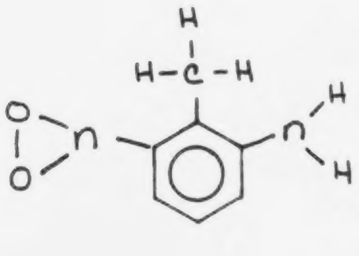
U169 Nitrobenzene



U172 n-nitroso-di-n-butyl-amine

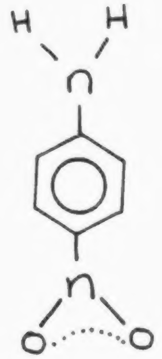


U174 n-Nitrosodiethylamine

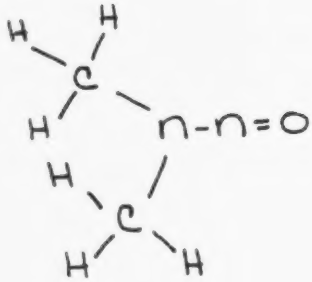


U181 5-Nitro-o-toluidine

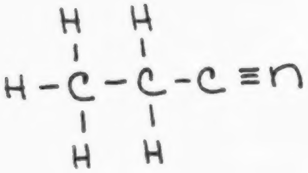
# Nitrogen Functional Groups
(analyzable)



P077 P-Nitroaniline



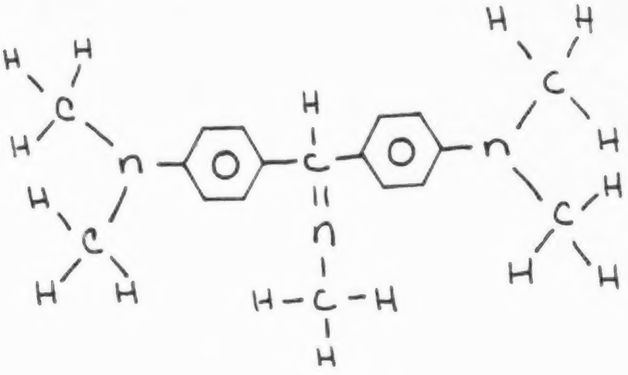
P082 N-Nitrosodimethylamine



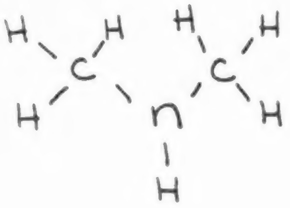
$\mathrm{H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-C\equiv N}$

P101 Propanenitrile

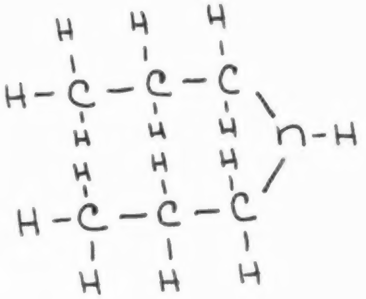
# Nitrogen Functional Groups
# (not analyzable)



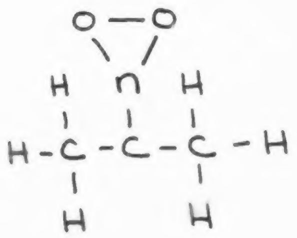
U014 auramine



U092 Dimethylamine

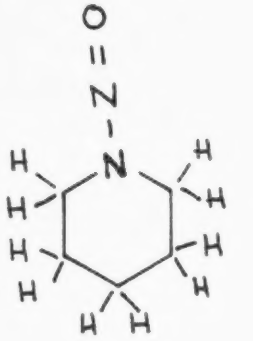


U110 Dipropylamine

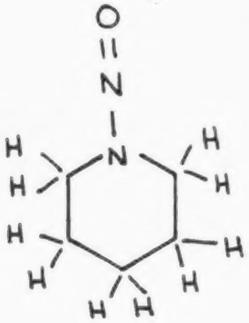


U171 2-Nitropropane

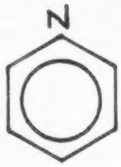
# Nitrogen Functional Groups
(analyzable)



U179 n-nitrosopiperidine

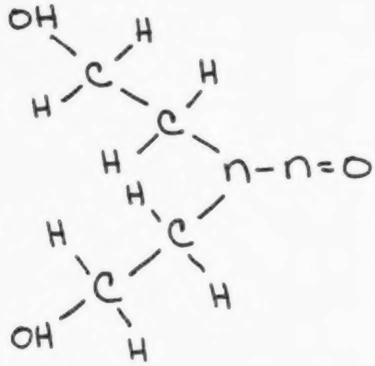


U180 n-nitrosopyrrolidine

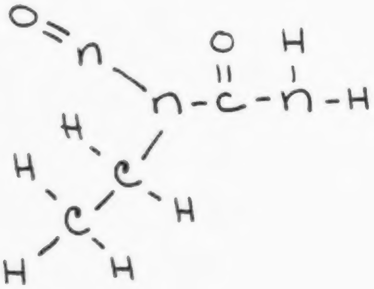


U196 Pyridine

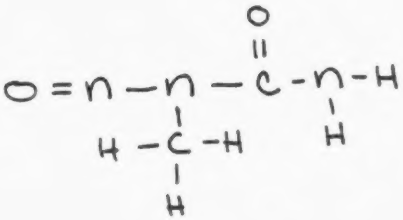
# Nitrogen Functional Groups
# (not analyzable)



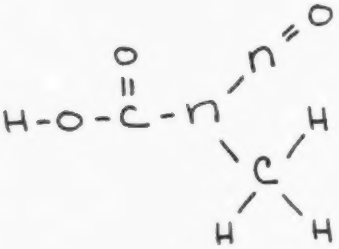
U173 n-nitroso-diethanolamine



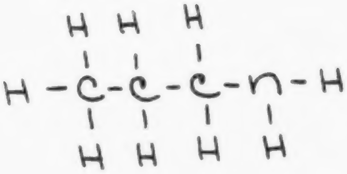
U176 n-nitroso-n-ethylurea



U177 n-nitroso-n-methylurea

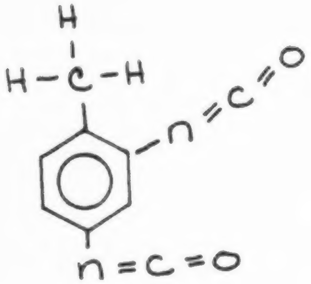


U178 n-nitroso-n-methyl-urethane

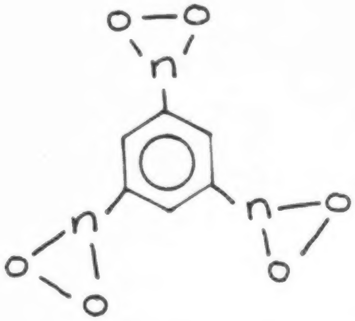


U194 n-Propylamine

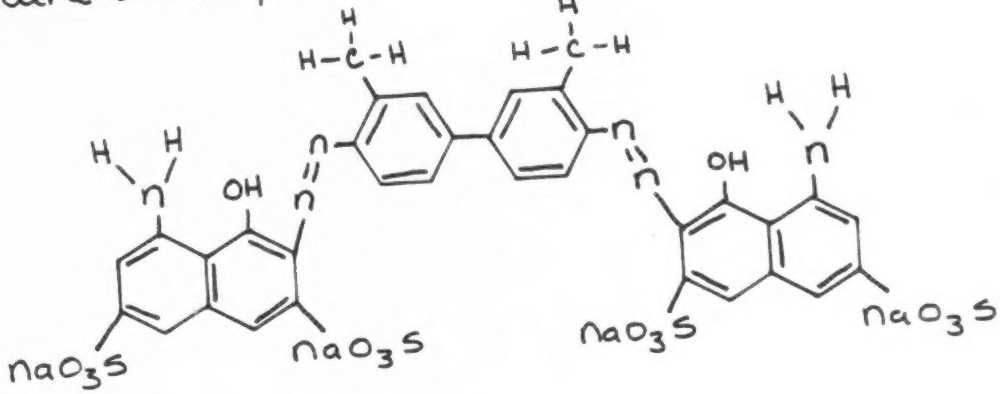
# Nitrogen Functional Groups
(not Analyzable)



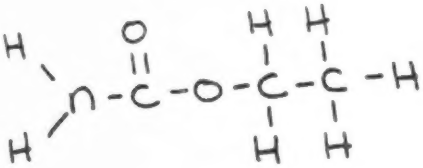
U223 Toluene diisocyanate



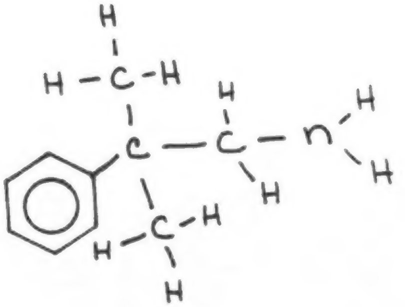
U234 Sym-Trinitrobenzene



U236 Trypan Blue

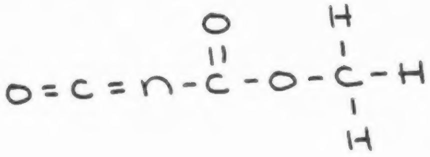


U238 Ethyl carbamate



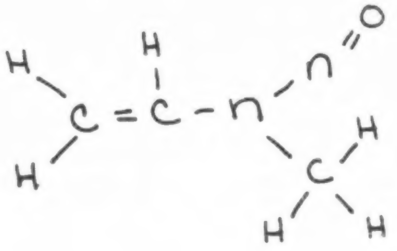
P046 alpha, alph-
dimethylphenethylamine

# Nitrogen Functional Groups
(not analyzable)

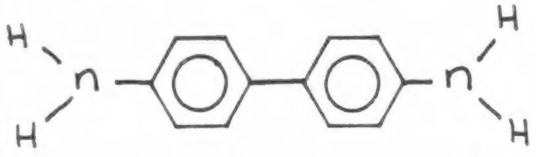


$$O=C=N-\overset{\overset{\displaystyle O}{\|}}{C}-O-\underset{\underset{\displaystyle H}{|}}{\overset{\overset{\displaystyle H}{|}}{C}}-H$$

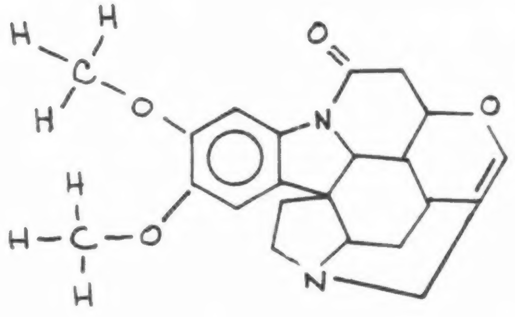
P064 Isocyanic acid, methyl ester



P084 N-Nitrosmethylvinylamine

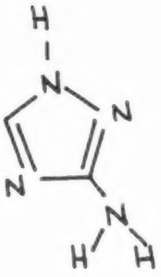


U021 Benzidine

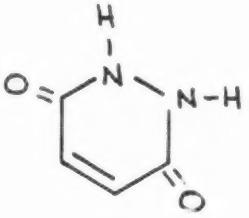


P018 Brucine

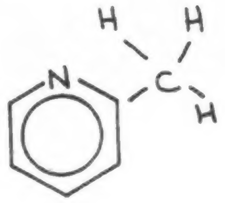
# Nitrogen Functional Groups
(not analyzable)



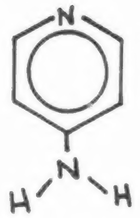
U011 amitrole



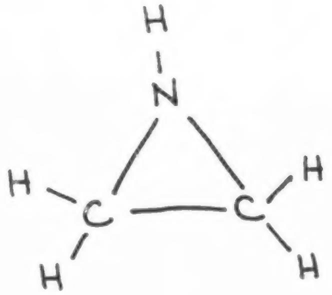
U148 maleic anhydride



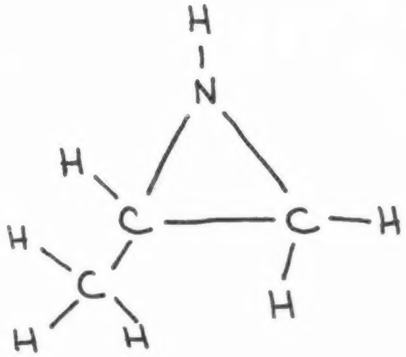
U191 2-picoline



P008 aminopyridine



P054 aziridine



P067 2-methylaziridine

# Appendix B

# PLANT CODE SUMMARY

## Table B-1

## PLANT CODE REFERENCE LIST

| Plant Code (Test Number) | Facility/Location | Reference No. |
|---|---|---|
| 1 | USEPA, Combustion Research Facility, Jefferson, AR | 9 |
| 2 | USEPA, Combustion Research Facility, Jefferson, AR | 10 |
| 3 | John Zink Test Facility, Tulsa, OK | 11 |
| 4 | Rollins Environmental Services (TX), Inc., Deer Park, TX | 12 |
| 5 | USEPA, Combustion Research Facility, Jefferson, AR | 13 |
| 6 | USEPA, Combustion Research Facility, Jefferson, AR | 14 |
| 7 | Amoco Oil Company, Whiting, IN | 15, 16 |
| 8 | USEPA Combustion Research Facility, Jefferson, AR | 17 |
| 9 | John Zink Test Facility, Tulsa, OK | 18 |
| 10 | John Zink Test Facility, Tulsa, OK | 19 |
| 11 | ENSCO, El Dorado, AR | 20 |
| 12 | John Zink Test Facility, Tulsa, OK | 21 |
| 13 | John Zink Test Facility, Tulsa, OK | 22 |
| 14 | John Zink Test Facility, Tulsa, OK | 22 |

## Appendix C

## ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

# Appendix C

# ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

As described in Section 6.2, matrix spike recoveries were used to correct detection limits to account for analytical interferences associated with the chemical matrices of the samples. In cases where a matrix spike was not performed for a waste constituent in the treatment test from which the detection limit was transferred, the matrix spike recovery for a similar constituent in that treatment test was transferred to that constituent with the exception of U017 wastewaters.

As discussed in Section 4.1, the U017 treatment standards were developed based on treatment performance data transferred from benzal chloride in K015 in test 12 and from p-dichlorobenzene in K019 in test 4. Since a matrix spike was not performed for benzal chloride in K015 scrubber water, the lower of the matrix spike and duplicate matrix spike recoveries for p-dichlorobenzene was used.

An accuracy correction factor was then determined for each constituent by dividing 100 by the matrix spike recovery (percent) for that constituent. An accuracy correction factor of 1 was used when both the matrix spike and duplicate matrix spike recoveries exceeded 100%, so that the data were not adjusted to concentrations below the detection limits. Matrix spike values of less than 20% are not acceptable and were not used to correct detection limits, nor included in average value calculations.

Table C-1 presents the matrix spike recoveries obtained in each of the 14 incineration tests. Matrix spike recoveries and accuracy correction factors used for each constituent except U017 are included in Tables 6-1 through 6-7 in Section 6.0. Table C-2 presents the matrix spike recovery data and accuracy correction factor for U017 wastewaters, and Table C-3 presents the corresponding accuracy corrected data. Table C-4 presents the matrix spike recovery data and accuracy correction factor for U017 nonwastewaters, and Table C-5 presents the corresponding accuracy corrected data.

TABLE C-1

MATRIX SPIKE RECOVERIES USED TO ADJUST DETECTION LIMITS

| BDAT # | Constituent | Test 1 | | Test 2 | | Test 3 | | Test 4 | | Test 5 | | Test 6 | | Test 7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ash | Scrubber Water | Ash | Scrubber Water | Ash | Scrubber Water | Ash | Scrubber Water | Ash | Scrubber Water | Ash | Scrubber Water | Ash | Scrubber Water |
| | **Volatile Organics:** | | | | | | | | | | | | | | |
| 1 | Acetonitrile | | | | | 79,80 | 88,88 | | | | | | | | |
| 2 | Acrolein | | | | | 80,47 | 1.3,0.84 | | | | | | | | |
| 3 | Acrylonitrile | | | | | 110,109 | 44,88 | | | | | | | | |
| 4 | Benzene | 88,86 | 82,120 | 78,88 | 90,85 | 141,148 | 103,109 | 90,85 | 84,89 | 104,104 | 112,112 | 104,104,88,94 | 85,89,95,87 | 88 | 111,117 |
| 9 | Chlorobenzene | 124,120 | 120,104 | 102,112 | 90,85 | 107,107 | 98,102 | 99,100 | 116,92 | 112,112 | 120,116 | 109,109,114,120 | 121,109,132,129 | 46 | 116,118 |
| 24 | 1,1-Dichloroethylene | | 82,118 | 88,96 | 100,87 | 99,104 | 71,58 | 86,79 | 48,44 | 140,138 | 180,184 | 88,88,58,56 | 50,39,59,50 | 98 | 164,156 |
| 229 | Methyl isobutyl ketone | | | | | | | | | | | | | | |
| 38 | Methylene Chloride | | | | | | | | | | | | | | |
| 43 | Toluene | 109,109 | 120,120 | 98,110 | 109,99 | 113,117 | 98,97 | | | 122,107 | 116,116 | 124,84,109,165 | 109,116,122,118 | 80 | 110,116 |
| 45 | 1,1,1-Trichloroethane | | | | | | | | | | | | | | |
| 47 | Trichloroethene | 88,84 | 84,84 | 87,77 | 89,84 | 104,105 | 81,83 | 107,112 | 84,109 | 104,108 | 84,80 | 84,84,80,80 | 79,79,80,80 | 76 | 112,116 |
| 216 | 1,2-Xylene | | | | | | | | | | | | | | 112,118 |
| 216,217 | 1,3-Xylene and 1,4-Xylene | | | | | | | | | | | | | | 109,119 |
| 215-217 | Total Xylenes | | | | | | | | | | | | | | |
| | **Semivolatile Organics:** | | | | | | | | | | | | | | |
| 51 | Acenaphthalene | | | | | | | | | | | | | | |
| 52 | Acenaphthene | 120,120 | 110,110 | 0,3.4 | 81,86 | | | 110,110 | 102,102 | 98,98 | 98,88 | 103,100 | 140,130 | 86,63 | 92,67 |
| 66 | Benzo(a)pyrene | | | | | | | | | | | | | | 99,59 |
| 70 | Bis(2-ethylhexyl)phthalate | | | | | | | | | | | | | | 84,65 |
| 73 | 2-sec-Butyl-4,6-dinitrophenol | | | 113,88 | 86,70 | | | | | | | | | | |
| 76 | p-Chloro-m-cresol | 80,85 | 29,22 | 35,88 | 80,73 | | | 110,120 | 87,85 | 98,98 | 49,47 | 88,88 | 95,95 | 58,57 | 138,81 |
| 78 | 2-Chlorophenol | 100,105 | 28,20 | 59,53 | 81,85 | | | 99,100 | 91,79 | 107,109 | 46,49 | 75,75 | 95,90 | 70,70 | 115,96 |
| 80 | Chrysene | | | | | | | | | | | | | | 109,65 |
| 87 | p-Dichlorobenzene | | | | | | | | | | | | | 75,76 | |
| 88 | o-Dichlorobenzene | 84,84 | 85,87 | 46,46 | 51,81 | | | 90,89 | 88,70 | 89,80 | 88,88 | 74,74 | 94,79 | | 79,84 |
| 98 | Di-n-butyl phthalate | | | | | | | | | | | | | | 109,47 |
| 102 | 2,4-Dinitrotoluene | 120,120 | 79,84 | 0,0 | 21,17 | | | 107,110 | 88,84 | 118,118 | 114,120 | 109,112 | 130,120 | 54,52 | 111,58 |
| 105 | Di-n-propylnitrosamine | 81,82 | 70,86 | 87,82 | 70,58 | | | 128,130 | 100,82 | 40,26 | 42,44 | 62,56 | 98,81 | 70,70 | 93,70 |
| 109 | Fluorene | | | | | | | | | | | | | | 106,56 |
| 110 | Hexachlorobenzene | | | | | | | | | | | | | | |
| 117 | Isosafrole | | | | | | | | | | | | | | |
| 121 | Naphthalene | | | | | | | | | | | | | | 119,86 |
| 127 | 4-Nitrophenol | 100,90 | 1.5,0.8 | 1.2,2.6 | 0,0 | | | 97,110 | 82,43 | 120,114 | 77,80 | 100,96 | 140,120 | 32,31 | 79,82 |
| 130 | Pentachlorophenol | 95,105 | 3,1.7 | 0,0 | 80,85 | | | 98,88 | 58,46 | 88,91 | 80,84 | 48,33 | 95,90 | 34,34 | 51,59 |
| 141 | Phenanthrene | | | | | | | | | | | | | | 89,71 |
| 142 | Phenol | 85,80 | 30,22 | 72,85 | 85,81 | | | 90,87 | 74,70 | 98,94 | 38,34 | 70,67 | 96,95 | 85,85 | 109,59 |
| 144 | Pronamide | | | | | | | | | | | | | | |
| 145 | Pyrene | 98,100 | 110,110 | 0,0 | 82,80 | | | 120,82 | 88,89 | 94,82 | 88,100 | 47,29 | 110,110 | 58,53 | 121,92 |
| 150 | 1,2,4-Trichlorobenzene | 85,100 | 110,120 | 30,30 | 72,54 | | | 75,80 | 90,88 | 90,80 | 72,72 | 95,88 | 100,94 | 90,88 | 89,84 |
| | **Organochlorine Pesticides:** | | | | | | | | | | | | | | |
| 178 | gamma-BHC | | | 62,75 | 80,56 | | | | | | | 64,56 | 84,75 | | |
| 181 | Dieldrin | | | | | | | | | | | 50,29 | 48,41 | | |
| 189 | Heptachlor | | | | | | | | | | | | | | |
| 187 | Heptachlor epoxide | | | 75,88 | 64,60 | | | | | | | 72,58 | 75,88 | | |
| 190 | Methoxychlor | | | 118,145 | 94,82 | | | | | | | 38,38 | 110,94 | | |
| | **Phenoxyacetic Acid Herbicides:** | | | | | | | | | | | | | | |
| 192 | 2,4-Dichlorophenoxyacetic acid | | | 42,69 | 89,117 | | | | | | | 55,38 | 99,94 | | |
| 193 | Silvex | | | | | | | | | | | 64,45 | 97,89 | | |
| 194 | 2,4,5-T | | | | | | | | | | | 38,27 | 92,88 | | |

TABLE C-1 (continued)

MATRIX SPIKE RECOVERIES USED TO ADJUST DETECTION LIMITS

| BDAT # Constituent | Test 8 Ash | Test 8 Scrubber Water | Test 9 Ash | Test 9 Scrubber Water | Test 10 Ash | Test 10 Scrubber Water | Test 11 Ash | Test 11 Scrubber Water | Test 12 Ash | Test 12 Scrubber Water | Test 13 Ash | Test 13 Scrubber Water | Test 14 Ash | Test 14 Scrubber Water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volatile Organics: | | | | | | | | | | | | | | |
| 1 Acetonitrile | | | | | | | | | | | | | | |
| 2 Acrolein | | | | | | | | | | | | | | |
| 3 Acrylonitrile | | | | | | | | | | | | | | |
| 4 Benzene | 100,88 | 108,108 | 102,108 | 90,92 | 104,108 | 92,90 | 129,130 | 98,90 | | 98,98 | 117,158 | 98,103 | 103,87 | 88,70 |
| 9 Chlorobenzene | 108,108 | 112,108 | 104,110 | 100,102 | 106,110 | 114,110 | 90,108 | 110,112 | | 116,112 | 92,66 | 121,130 | 115,109 | 116,87 |
| 24 1,1-Dichloroethylene | 114,114 | 110,108 | 100,96 | 90,62 | 126,130 | 78,74 | 80,122 | 90,90 | | 48,48 | 35,32 | 73,76 | 75,73 | 89,57 |
| 229 Methyl isobutyl ketone | | | | | | | | | | | 88,117 | 131,140 | 48,43 | 154,121 |
| 30 Methylene Chloride | | | | | | | | | | | 300,309 | 109,127 | 120,124 | 101,91 |
| 43 Toluene | 108,104 | 124,184 | 106,118 | 90,92 | 112,114 | 104,102 | 170,222 | 114,114 | | 104,100 | 243,158 | 113,122 | 108,93 | 108,91 |
| 45 1,1,1-Trichloroethane | | | | | | | | | | | 539,686 | 122,134 | 108,110 | 113,105 |
| 47 Trichloroethene | 114,114 | 114,118 | 118,128 | 98,102 | 112,116 | 114,110 | 178,218 | 108,108 | | 92,92 | 210,294 | 114,129 | 108,103 | 115,98 |
| 215 1,2-Xylene | | | | | | | | | | | | | | |
| 216,217 1,3-Xylene and 1,4-Xylene | | | | | | | | | | | | | | |
| 215-217 Total Xylenes | | | | | | | | | | | 61,23 | 92,99 | 92,81 | 92,93 |
| Semivolatile Organics: | | | | | | | | | | | | | | |
| 51 Acenaphthalene | | | 41,39 | 55,58 | 73,74 | 92,85 | | | | | | | | |
| 52 Acenaphthene | 83,81 | 104,94 | | | | | 30,88 | 76,90 | | 76,80 | 51,24 | 53,84 | 90,54 | 60,56 |
| 62 Benzo(a)pyrene | | | | | | | | | | | | | | |
| 70 Bis(2-ethylhexyl)phthalate | | | | | | | | | | | 88,78 | 92,99 | 79,71 | 106,112 |
| 73 2-sec-Butyl-4,6-dinitrophenol | | | | | | | | | | | 86,13 | 0,0 | 41,41 | 122,123 |
| 76 p-Chloro-m-cresol | 92,87 | 107,103 | 47,44 | 69,73 | 86,84 | 104,109 | 98,135 | | | 90,95 | 88,84 | 95,72 | 90,79 | 81,83 |
| 78 2-Chlorophenol | 79,83 | 106,109 | 41,39 | 62,59 | 82,58 | 85,92 | 78,102 | | | 75,70 | 49,42 | 88,59 | 53,41 | 51,74 |
| 80 Chrysene | | | | | | | | | | | | | | |
| 87 p-Dichlorobenzene | | | | | | | | | | | | | | |
| 89 o-Dichlorobenzene | 79,89 | 79,87 | 40,39 | 33,33 | 75,70 | 49,49 | 72,90 | 64,58 | | 40,37 | 28,23 | 31,34 | 29,17 | 30,36 |
| 98 Di-n-butyl phthalate | | | | | | | | | | | | | | |
| 102 2,4-Dinitrotoluene | 121,109 | 126,124 | 49,47 | 42,53 | 59,59 | 92,94 | 38,100 | 114,114 | | 25,25 | 73,58 | 38,37 | 71,63 | 71,77 |
| 105 Di-n-propylnitrosamine | 92,84 | 104,99 | 46,45 | 59,60 | 64,61 | 91,92 | 118,119 | 122,119 | | 75,85 | 58,60 | 70,67 | 53,46 | 59,72 |
| 108 Fluorene | | | | | | | | | | | | | | |
| 110 Hexachlorobenzene | | | | | | | | | | | 54,21 | 48,32 | 74,139 | 63,71 |
| 117 Isosafrole | | | | | | | | | | | 34,28 | 70,77 | 44,39 | 49,60 |
| 121 Naphthalene | | | | | | | | | | | | | | |
| 127 4-Nitrophenol | 37,35 | 117,118 | 33,32 | 0,0 | 22,21 | 113,127 | 60,90 | | | 100,120 | 91,48 | 0,0 | 77,64 | 110,98 |
| 130 Pentachlorophenol | 7,11 | 107,95 | 30,25 | 51,53 | 38,35 | 56,92 | 27,84 | | | 70,85 | 74,0 | 91,77 | 77,88 | 103,11 |
| 141 Phenanthrene | | | | | | | | | | | | | | |
| 142 Phenol | 77,80 | 99,93 | 41,40 | 80,58 | 85,81 | 100,107 | 101,122 | | | 80,55 | 70,61 | 90,62 | 70,60 | 40,72 |
| 144 Pronamide | | | | | | | | | | | 98,69 | 78,90 | 92,84 | 26,12 |
| 145 Pyrene | 34,38 | 143,146 | 48,45 | 82,83 | 85,79 | 99,102 | 8,62 | 88,82 | | 52,82 | 49,0 | 74,86 | 73,86 | 47,49 |
| 150 1,2,4-Trichlorobenzene | 84,89 | 77,85 | 41,39 | 40,41 | 75,78 | 52,54 | 80,90 | 82,84 | | 37,35 | 30,25 | 35,36 | 39,24 | 32,38 |
| Organochlorine Pesticides: | | | | | | | | | | | | | | |
| 178 gamma-BHC | | | | | | | | | | | | | | |
| 181 Dieldrin | | | | | | | | | | | | | | |
| 186 Heptachlor | | | | | | | | | | | 54,29 | 87,64 | 88,93 | 70,73 |
| 187 Heptachlor epoxide | | | | | | | | | | | | | | |
| 190 Methoxychlor | | | | | | | | | | | 16,0 | 77,78 | 0,42 | 107,102 |
| Phenoxyacetic Acid Herbicides: | | | | | | | | | | | | | | |
| 192 2,4-Dichlorophenoxyacetic acid | | | | | | | | | | | 0,0 | 22,172 | 0,0 | 0,0 |
| 193 Silvex | | | | | | | | | | | 0,0 | 0 | 0,0 | 0,0 |
| 194 2,4,5-T | | | | | | | | | | | 0,0 | 0 | 0,0 | 0,0 |

Table C-2

BASE NEUTRAL MATRIX SPIKE DATA FOR K015 SCRUBBER WATER RESIDUAL

| Compound | Percent Recovery | |
|---|---|---|
| | Matrix Spike | Matrix Spike Duplicate |
| 1,4-Dichlorobenzene | 40 | 37 |
| N-nitroso-di-n-propylamine | 75 | 65 |
| 1,2,4-Trichlorobenzene | 37 | 35 |
| Acenaphthene | 76 | 80 |
| 2,4-Dinitrotoluene | 25 | 25 |
| Pyrene | 52 | 62 |
| Average: | 50.83 | 50.66 |

Accuracy Correction Factor (ACF) = 100/50.66 = 1.974

Source: BDAT Background Document for K015 (Reference 21).

Table C-3

## ACCURACY CORRECTED DATA FOR K015 SCRUBBER WATER RESIDUAL

| | Constituent | Accuracy-Corrected Concentration (ppm) Sample Set #1 | Sample Set #2 | Sample Set #3 |
|---|---|---|---|---|
| 218. | Benzal Chloride | <0.09869 | 0.1303 | 0.1856 |

Average treated waste concentration: 0.1382 ppm

Note: See Table 4-5 for uncorrected data.

## Table C-4

## MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUAL

| Spike Constituent | Original Amount Found (ppm) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| | | Amount Spiked (ppm) | Amount Recovered (ppm) | Percent Recovery[a] (%) | Amount Spiked (ppm) | Amount Recovered (ppm) | Percent Recovery[a] (%) |
| SEMIVOLATILE ORGANICS (ACID EXTRACTABLES) | | | | | | | |
| 76. p-Chloro-m-cresol | <5 | 100 | 110 | 110 | 100 | 120 | 120 |
| 78. 2-Chlorophenol | <2 | 100 | 98 | 98 | 100 | 100 | 100 |
| 127. 4-Nitrophenol | <10 | 100 | 97 | 97 | 100 | 110 | 110 |
| 139. Pentachlorophenol | <50 | 100 | 88 | 88 | 100 | 88 | 88 |
| 142. Phenol | <2 | 100 | 90 | 90 | 100 | 97 | 97 |
| SEMIVOLATILE ORGANICS (BASE/NEUTRAL FRACTION) | | | | | | | |
| 52. Acenaphthene | <2 | 50 | 55 | 110 | 50 | 55 | 110 |
| 88. 1,4-Dichlorobenzene[b] | <2 | 50 | 45 | 90 | 50 | 49.5 | 99 |
| 102. 2,4-Dinitrotoluene | <50 | 50 | 53.5 | 107 | 50 | 55 | 110 |
| 105. N-Nitroso-di-n-propylamine | <5 | 50 | 60 | 120 | 50 | 65 | 130 |
| 145. Pyrene | <2 | 50 | 60 | 120 | 50 | 46 | 92 |
| 150. 1,2,4-Trichlorobenzene | <5 | 50 | 37.5 | 75 | 50 | 40 | 80 |

[a] Percent recovery = 100 x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

[b] As described in Section 4.1, 1,4-dichlorobenzene data were transferred to benzal chloride for U017 nonwastewaters. The accuracy correction factor (ACF) used was: 100/90 = 1.11 = ACF.

Source: Non-confidential version of the Onsite Engineering Report of Treatment Technology Performance and Operation for Rollins Environmental Services (TX) Inc., Deer Park, TX (Reference 12).

## Table C-5

## ACCURACY CORRECTED DATA FOR K019
## KILN ASH RESIDUAL

| BDAT List Constituent | Sample Set # | Uncorrected[a] Concentration (ppm) | Accuracy-Corrected Concentration (ppm) |
|---|---|---|---|
| 88. 1,4-Dichlorobenzene | 1 | <2 | <2.22 |
| | 2 | <2 | <2.22 |
| | 3 | <2 | <2.22 |
| | 4 | <2 | <2.22 |
| | 5 | <2 | <2.22 |
| | 6 | <2 | <2.22 |
| | Average treated waste concentration: | | 2.22 |

[a] Source: Non-confidential version of the Onsite Engineering Report of Treatment Technology Performance and Operation for Rollins Environmental Services (TX) Inc., Deer Park, TX (Reference 12).

# Appendix D

# VARIABILITY FACTOR CALCULATIONS

# APPENDIX D

As noted in Section 6.1, the variability factor accounts for the variability inherent in treatment system performance, treatment residual collection, and treatment sample analysis. For more information on calculation of variability factors, see EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).

A variability factor was calculated for a constituent when the test from which the detection limit was transferred contained the constituent at concentrations above the detection limit in the treatment residual (ash or scrubber water). This situation occurred for five constituents proposed for regulation: U075 nonwastewaters, and U017, U043, U045, and U196 wastewaters.

In one case, U075 nonwastewaters, there were two tests from which the highest detection limit was transferred. Data from both tests were pooled for the variability factor calculation.

The variability factors and the data used to calculate them are shown in Table D-1 for U075 nonwastewaters and U017, U043, U045, and U196 wastewaters.

Table D-1

## VARIABILITY FACTOR CALCULATIONS

U075 NONWASTEWATERS

INPUT DATA:

| | |
|---|---|
| Constituent: | Dichlorodifluoromethane |
| BDAT Number: | 21 |
| Accuracy Correction Factor: | 1 |

| Source Test # | Sample Set | Unadjusted Value (ppm) | A or DL | Adjusted Value (ppm) | ln of Adj Values |
|---|---|---|---|---|---|
| 7 | 1 | 2 | DL | 2 | 0.693147 |
| 7 | 2 | 2 | DL | 2 | 0.693147 |
| 7 | 3 | 2 | DL | 2 | 0.693147 |
| 7 | 4 | 2 | DL | 2 | 0.693147 |
| 7 | 5 | 2 | DL | 2 | 0.693147 |
| 7 | 6 | 2 | DL | 2 | 0.693147 |
| 5 | 7 | 2 | DL | 2 | 0.693147 |
| 5 | 8 | 2 | DL | 2 | 0.693147 |
| 5 | 9 | 23 | A | 23 | 3.135494 |

RESULTS:

Mean of Adj Values = 4.3333
Mean of lns = 0.9645
STD of lns = 0.8141
C99 = 17.4861
VF = 4.0353

A - Actual value detected in treatment residual.

DL - Detection limit (given when not detected in treatment residual).

Table D-1

VARIABILITY FACTOR CALCULATIONS (Continued)

U043 WASTEWATERS

INPUT DATA:

| | |
|---|---|
| Constituent: | Vinyl Chloride |
| BDAT Number: | 50 |
| Accuracy Correction Factor: | 1.25 |

| Sample Set | Unadjusted Value (ppm) | A or DL | Adjusted Value (ppm) | ln of Adj Values |
|---|---|---|---|---|
| 1 | 0.01 | DL | 0.0125 | -4.38202 |
| 2 | 0.01 | DL | 0.0125 | -4.38202 |
| 3 | 0.01 | DL | 0.0125 | -4.38202 |
| 4 | 0.01 | DL | 0.0125 | -4.38202 |
| 5 | 0.01 | DL | 0.0125 | -4.38202 |
| 6 | 0.03 | A | 0.0375 | -3.28341 |

RESULTS:

Mean of Adj Values = 0.0167
Mean of lns = -4.1989
STD of lns = 0.4485
C99 = 0.0427
VF = 2.5611

A - Actual value detected in treatment residual.

DL - Detection limit (given when not detected in treatment residual).

## Table D-1

## VARIABILITY FACTOR CALCULATIONS (Continued)

U045 WASTEWATERS

INPUT DATA:

| | |
|---|---|
| Constituent: | Chloromethane |
| BDAT Number: | 15 |
| Accuracy Correction Factor: | 1.25 |

| Sample Set | Unadjusted Value (ppm) | A or DL | Adjusted Value (ppm) | ln of Adj Values |
|---|---|---|---|---|
| 1 | 0.01 | DL | 0.0125 | -4.38202 |
| 2 | 0.01 | DL | 0.0125 | -4.38202 |
| 3 | 0.01 | DL | 0.0125 | -4.38202 |
| 4 | 0.01 | DL | 0.0125 | -4.38202 |
| 5 | 0.01 | DL | 0.0125 | -4.38202 |
| 6 | 0.02 | A | 0.0025 | -3.68887 |

RESULTS:

Mean of Adj Values = 0.0146
Mean of lns = -4.2665
STD of lns = 0.2830
C99 = 0.0271
VF = 1.8602

A - Actual value detected in treatment residual.

DL - Detection limit (given when not detected in treatment residual).

## VARIABILITY FACTOR CALCULATIONS (Continued)

### U196 WASTEWATERS

INPUT DATA:

| | |
|---|---|
| Constituent: | Pyridine SW |
| BDAT Number: | 39 |
| Accuracy Correction Factor: | 1.0 |

| Sample Set | Unadjusted Value (ppm) | A or DL | Adjusted Value (ppm) | ln of Adj Values |
|---|---|---|---|---|
| 1 | 0.005 | DL | 0.00545 | -5.21213 |
| 2 | 0.005 | DL | 0.00545 | -5.21213 |
| 3 | 0.005 | DL | 0.00545 | -5.21213 |
| 4 | 0.005 | DL | 0.00545 | -5.21213 |
| 5 | 0.005 | DL | 0.00545 | -5.21213 |
| 6 | 0.061 | A | 0.06649 | -2.71070 |

RESULTS:

Mean of Adj Values = 0.0156
Mean of lns = -4.7952
STD of lns = 1.0212
C99 = 0.0893
VF = 5.7154

A - Actual value detected in treatment residual.

DL - Detection limit (given when not detected in treatment residual).

## VARIABILITY FACTOR CALCULATIONS (Continued)

U017 WASTEWATERS

INPUT DATA:

| | |
|---|---|
| Constituent: | Benzal Chloride SW |
| BDAT Number: | 218 |
| Accuracy Correction Factor: | 1.974 |

| Sample Set | Unadjusted Value (ppm) | A or DL | Adjusted Value (ppm) | ln of Adj Values |
|---|---|---|---|---|
| 1 | 0.05 | DL | 0.0987 | -2.31569 |
| 2 | 0.066 | A | 0.130 | -2.03806 |
| 3 | 0.94 | A | 0.186 | -1.68442 |

RESULTS:

Mean of Adj Values = 0.1382
Mean of lns = -2.0127
STD of lns = 0.3164
C99 = 0.2793
VF = 2.0212

A - Actual value detected in treatment residual.

DL - Detection limit (given when not detected in treatment residual).

# Appendix E

# TREATMENT PERFORMANCE DATA

Section

Treatment Performance Data for Methoxychlor, 1,1,1-Trichloroethane, and Carbon Tetrachloride .................... E.1

Treatment Performance Data for Chlorobenzene and Tetrachloroethene .............................................. E.2

# Appendix E.1

# TREATMENT PERFORMANCE DATA FOR METHOXYCHLOR, 1,1,1-TRICHLOROETHANE, AND CARBON TETRACHLORIDE

Table E-1

CHARACTERIZATION DATA FOR WASTE TREATED AT TESTS 13 AND 14

| BDAT List Constituents | Concentration in the Untreated Waste from Test 13 (ppm) | Concentration in the Untreated Waste from Test 14 (ppm) |
|---|---|---|
| Volatile Organics | | |
| 7. Carbon Tetrachloride | 560 | <5,000 |
| 38. Methylene chloride | 63 | 87,000 |
| 229. Methyl isobutyl ketone | 130 | 52,000 |
| 43. Toluene | 63 | 69,000 |
| 45. 1,1,1-Trichloroethane | 63 | 130,000 |
| Semivolatile Organics | | |
| 70. Bis(2-ethylhexyl)phthalate | <19 | 28,000 |
| 73. 2-sec-Butyl-4,6-dinitropheno | <19 | 77,000 |
| 90. 2,4-Dichlorophenol | 140 | <400 |
| 110. Hexachlorobenzene | 13000 | <400 |
| 111. Hexachlorobutadiene | 22 | <400 |
| 112. Hexachlorocyclopentadiene | 120 | <400 |
| 117. Isosafrole | <19 | 35,000 |
| 122. 1,4-Naphthoquinone | <19 | 28,000 |
| 142. Phenol | <19 | 13,000 |
| 144. Pronamide | 24000 | <400 |
| Metals | | |
| 154. Antimony | 10.5 | <2.4 |
| 155. Arsenic | 2.2 | <1.0 |
| 156. Barium | 76.1 | 0.42 |
| 157. Beryllium | 0.31 | <0.1 |
| 158. Cadmium | <0.5 | 1.2 |
| 159. Chromium (Total) | 41.2 | 1.2 |
| 160. Copper | 27.9 | 9.8 |
| 161. Lead | 3.8 | 4.4 |
| 163. Nickel | 19.7 | 2.0 |
| 167. Vanadium | 18.2 | <0.3 |
| 168. Zinc | 45.1 | 17.3 |
| Inorganics | | |
| 169. Cyanide | <0.47 | 3.4 |
| 170. Fluoride | 6 | 0.1 |
| Organochlorine Pesticides | | |
| 177. Chlordane (alpha and gamma) | 6600 | <2.0 |
| 186. Heptachlor | 16000 | <0.99 |
| 190. Methoxychlor | 50000 | <2.0 |

Source: Onsite Engineering Report for the Third Third Incineration Test (Reference 22).

## Table E-2

## ANALYTICAL RESULTS FOR INCINERATOR ASH FROM TESTS 13 AND 14

| | Concentration in Kiln Ash Total Composition (mg/kg) Test 13 | | | | Concentration in Kiln Ash Total Composition (mg/kg) Test 14 | | | |
|---|---|---|---|---|---|---|---|---|
| BDAT List Constituents | Sample Set #1 | Sample Set #2 | Sample Set #3 | Sample Set #4 | Sample Set #1 | Sample Set #2 | Sample Set #3 | Sample Set #4 |
| **Volatile Organics** | | | | | | | | |
| 7. Carbon Tetrachloride | 0.008 | <0.005 | <0.01 | 0.048 | <0.01 | <0.01 | <0.01 | <0.01 |
| 38. Methylene Chloride | <0.005 | 0.012 | 0.015 | 0.090 | 0.016 | <0.01 | <0.01 | <0.01 |
| **Metals** | | | | | | | | |
| 154. Antimony | 8.4 | <2.4 | 5.2 | 9.3 | <2.4 | <2.4 | <2.4 | 2.8 |
| 155. Arsenic | 2.1 | 2 | 2.5 | 2.1 | 3.1 | 2.8 | 3.0 | 2.4 |
| 156. Barium | 59.3 | 12.4 | 22.8 | 82.2 | 12.3 | 9.3 | 16.1 | 17.4 |
| 157. Beryllium | 0.21 | <0.1 | <0.1 | 0.26 | <0.1 | <0.1 | <0.1 | <0.1 |
| 159. Chromium (Total) | 10 | 2.2 | 2.8 | 15.1 | 1.7 | 1.0 | 2.5 | 2.7 |
| 160. Copper | 64 | 13.7 | 41.1 | 29.9 | 3.5 | 1.6 | 3.4 | 3.0 |
| 161. Lead | 4 | 5 | 2 | 1.8 | 0.83 | 1.1 | 1.5 | <0.5 |
| 162. Mercury | <0.1 | 0.61 | <0.1 | 3.5 | <0.1 | <0.1 | <0.1 | <0.1 |
| 163. Nickel | 15.2 | 3.7 | 14.4 | 18.5 | 1.5 | 1.3 | 2.5 | 2.3 |
| 167. Vanadium | 8.5 | 1.9 | 2.5 | 12.3 | 5.7 | 4.6 | 6.7 | 9.2 |
| 168. Zinc | 9.6 | 2.3 | 4.9 | 6.2 | 2.7 | 3.7 | 3.6 | 3.5 |
| **Inorganics** | | | | | | | | |
| 170. Fluoride | 0.4 | 0.4 | NA | NA | NA | 2.7 | NA | NA |
| 171. Sulfide | NA | 3,060 | NA | NA | NA | <1.0 | NA | NA |
| **Phenoxyacetic Acid Herbicides** | | | | | | | | |
| 192. 2,4-Dichlorophenoxy acetic acid | 0.021 | <0.2 | <0.2 | <0.2 | 0.002 | 0.0019 | 0.002 | 0.002 |

NA - Not Analyzed.

Source: Onsite Engineering Report for the Third Third Incineration Test (Reference 22).

Table E-3

ANALYTICAL RESULTS FOR SCRUBBER WATER FROM TESTS 13 AND 14

| BDAT List Constituents | Concentration in Scrubber Water Total Composition (mg/l) Test 13 | | | | Concentration in Scrubber Water Total Composition (mg/l) Test 14 | | | |
|---|---|---|---|---|---|---|---|---|
| | Sample Set #1 | Sample Set #2 | Sample Set #3 | Sample Set #4 | Sample Set #1 | Sample Set #2 | Sample Set #3 | Sample Set #4 |
| Metals | | | | | | | | |
| 154. Antimony | 1.36 | NA | NA | NA | 0.285 | NA | NA | NA |
| 155. Arsenic | 1.98 | NA | NA | NA | 0.348 | NA | NA | NA |
| 156. Barium | 1.70 | NA | NA | NA | 0.131 | NA | NA | NA |
| 157. Beryllium | 0.0019 | NA | NA | NA | <0.001 | NA | NA | NA |
| 158. Cadmium | 0.826 | NA | NA | NA | 0.0618 | NA | NA | NA |
| 159. Chromium (Total) | 41.4 | NA | NA | NA | 5.38 | NA | NA | NA |
| 160. Copper | 17.8 | NA | NA | NA | 2.91 | NA | NA | NA |
| 161. Lead | 20.3 | NA | NA | NA | 2.48 | NA | NA | NA |
| 162. Mercury | 0.0044 | NA | NA | NA | 0.00038 | NA | NA | NA |
| 163. Nickel | 15.6 | NA | NA | NA | 2.46 | NA | NA | NA |
| 165. Silver | 0.0799 | NA | NA | NA | 0.0139 | NA | NA | NA |
| 166. Thallium | 0.022 | NA | NA | NA | 0.013 | NA | NA | NA |
| 167. Vanadium | 0.36 | NA | NA | NA | 0.0636 | NA | NA | NA |
| 168. Zinc | 40.2 | NA | NA | NA | 3.35 | NA | NA | NA |
| Inorganics | | | | | | | | |
| 170. Fluoride | 56.4 | NA | NA | NA | 23 | 25 | NA | NA |
| 171. Sulfide | NA | 129 | NA | NA | NA | 11.8 | NA | NA |
| Phenoxyacetic Acid Herbicides | | | | | | | | |
| 192. 2,4-Dichlorophenoxy acetic acid | 0.0074 | 0.0069 | 0.011 | 0.0041 | <0.00013 | <0.00013 | <0.00013 | <0.00013 |

NA - Not Analyzed.

Source: Onsite Engineering Report for the Third Third Incineration Test (Reference 22).

## Table E-4

## DESIGN AND OPERATING DATA FOR THE INCINERATION SYSTEM AT TESTS 13 AND 14

### TEST 13

| Time of Data Collection | Corresponding Sample Set | Kiln Temperature (F) | Solids Mixture Feed Rate (lbs/hr) | Kiln Rotational Speed (rpm) | Primary Afterburner Temperature (F) |
|---|---|---|---|---|---|
| 1200 | pre-test | NR | 740 | 0.32 | NR |
| 1300 | pre-test | NR | 740 | 0.32 | NR |
| 1345 | pre-test | 1400 - 1700 | 740 | 0.32 | 1700 - 1800 |
| 1545 | pre-test | 1400 - 1700 | 740 | 0.32 | 1700 - 1800 |
| 1615 | pre-test | 1400 - 1700 | 740 | 0.32 | 1700 - 1800 |
| 1630 | pre-test | 1400 - 1700 | 740 | 0.32 | 1700 - 1800 |
| 1645 | pre-test | 1400 - 1700 | 740 | 0.32 | 1700 - 1800 |
| 1700 | sample set #1 | 1500 - 1700 | 740 | 0.32 | 1800 |
| 1715 | sample set #1 | 1500 - 1700 | 740 | 0.32 | 1800 |
| 1730 | sample set #1 | 1500 - 1700 | 740 | 0.32 | 1800 |
| 1745 | sample set #1 | 1500 - 1700 | 740 | 0.32 | 1800 |
| 1815 | sample set #2 | 1600 - 1800 | 740 | 0.32 | 1800 - 1900 |
| 1830 | sample set #2 | 1600 - 1800 | 740 | 0.32 | 1800 - 1900 |
| 1845 | sample set #2 | 1600 - 1800 | 740 | 0.32 | 1800 - 1900 |
| 1900 | sample set #3 | 1700 - 1900 | 740 | 0.32 | 1800 - 1900 |
| 1930 | sample set #3 | 1700 - 1900 | 740 | 0.32 | 1800 - 1900 |
| 2000 | sample set #4 | 1600 - 1800 | 740 | 0.32 | 1800 |
| 2015 | sample set #4 | 1600 - 1800 | 740 | 0.32 | 1800 |
| 2030 | sample set #4 | 1600 - 1800 | 740 | 0.32 | 1800 |
| 2045 | sample set #4 | 1600 - 1800 | 740 | 0.32 | 1800 |

### TEST 14

| Time of Data Collection | Corresponding Sample Set | Kiln Temperature (F) | Soil Feed Rate (lbs/hr) | Liqiud Mixture Feed Rate (gal/hr) | Kiln Rotational Speed (rpm) | Primary Afterburner Temperature (F) |
|---|---|---|---|---|---|---|
| 0830 | pre-test | 1600 - 1800 | 540 | 0 | 0.25 | 1800 |
| 0915 | begin liquid feed | 1600 - 1800 | NR | 24 | NR | NR |
| 0930 | pre-test | 1600 - 1800 | 540 | 28 | 0.25 | 1800 |
| 1000 | pre-test | 1600 - 1800 | 540 | 28 | 0.25 | 1800 |
| 1055 | sample set #1 | 1700 | 540 | 28 | 0.25 | 1700 - 1800 |
| 1145 | sample set #2 | 1700 | 540 | 28 | 0.25 | 1800 |
| 1215 | sample set #2 | 1700 | 540 | 28 | 0.25 | 1800 |
| 1245 | sample set #3 | 1700 | 540 | 28 | 0.25 | 1800 |
| 1315 | sample set #3 | 1700 | 540 | 28 | 0.25 | 1800 |
| 1345 | sample set #4 | 1700 - 1800 | 540 | 28 | 0.25 | 1600 - 2000 |
| 1410 | kiln shut off | 1800 | NR | NR | 0.25 | 1800 |

NR - Not Reported.

Source: Onsite Engineering Report for the Third Third Incineration Test (Reference 22).

## Appendix E.2

## TREATMENT PERFORMANCE DATA FOR CHLOROBENZENE AND TETRACHLOROETHENE

Table E-5

## WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| | Wastes fed to the Rotary Kiln[a] | | Wastes fed to the Secondary Combustor | |
|---|---|---|---|---|
| BDAT List Constituent | K019 (ppm) | RCRA Blend (ppm) | PCB Blend (ppm) | Mercaptan-Contaminated Waste (ppm) |
| VOLATILES | | | | |
| 4. Benzene | <2,000 | 2,000 | <2,000 | 17.0 |
| 7. Carbon tetrachloride | 3,500-4,100 | <8 | <2,000 | 1.9 |
| 9. Chlorobenzene | <2,000-3,000 | <8 | <2,000 | <0.4 |
| 14. Chloroform | 4,600-6,000 | <8 | <2,000 | <0.4 |
| 22. 1,1-Dichloroethane | <2,000-2,200 | <8 | <2,000 | <0.4 |
| 23. 1,2-Dichloroethane | 87,000-130,000 | <8 | <2,000 | <0.4 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10,000 | 3.5 |
| 38. Methylene chloride | <10,000 | 910 | <10,000 | <2.0 |
| 42. Tetrachloroethene | 6,000-7,800 | 490 | <10,000 | <0.4 |
| 43. Toluene | <2,000 | 2,300 | <2,000 | 3.7 |
| 45. 1,1,1-Trichloroethane | 33,000-81,000 | 130 | <2,000 | 2.3 |
| 47. Trichloroethene | 2,200-3,210 | 360 | 3,600 | <0.4 |
| 215-217. Xylene (total) | <2,000 | 3,400 | 36,000 | 4.4 |
| 222. Acetone | <10,000 | 1,200 | <10,000 | <2.0 |
| 226. Ethyl benzene | <2,000 | 2,200 | 16,000 | 4.1 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10,000 | <2.0 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. Only one sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

Table E-5 (Continued)

## WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| BDAT List Constituent | | Wastes fed to the Rotary Kiln[a] | | Wastes fed to the Secondary Combustor | |
|---|---|---|---|---|---|
| | | K019 (ppm) | RCRA Blend (ppm) | PCB Blend (ppm) | Mercaptan-Contaminated Waste (ppm) |
| SEMIVOLATILES | | | | | |
| 51. | Acenaphthalene | <10 | 150 | 120 | <0.002 |
| 52. | Acenaphthene | <10 | <20 | 480 | <0.002 |
| 56. | Aniline | <25 | <50 | <250 | 1.220 |
| 57. | Anthracene | <10 | 110 | 400 | <0.002 |
| 65. | Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 |
| 68. | Bis(2-chloroethyl)ether | 280-340 | <20 | <100 | <0.002 |
| 70. | Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 |
| 80. | Chrysene | SNA | 28 | <100 | <0.002 |
| 81. | ortho-Cresol | <10 | <20 | <100 | 0.020 |
| 87. | o-Dichlorobenzene | <10 | 250 | 1,060 | 2.550 |
| 88. | p-Dichlorobenzene | 74-90 | 32 | 460 | 0.260 |
| 90. | 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 |
| 91. | 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. One sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

Table E-5 (Continued)

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019
AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| | Wastes fed to the Rotary Kiln[a] | | Wastes fed to the Secondary Combustor | |
|---|---|---|---|---|
| BDAT List Constituent | K019 (ppm) | RCRA Blend (ppm) | PCB Blend (ppm) | Mercaptan-Contaminated Waste (ppm) |
| SEMIVOLATILES (Cont.) | | | | |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 |
| 109. Fluorene | 16-22 | 53 | 340 | <0.002 |
| 110. Hexachlorobenzene | 60-87 | <100 | <500 | 0.022 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 |
| 113. Hexachloroethane | 85-120 | <100 | <500 | 0.018 |
| 121. Naphthalene | 314-470 | <20 | 400 | 0.133 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 |
| 136. Pentachlorobenzene | 51-65 | <100 | 1,000 | 0.020 |
| 141. Phenanthrene | 11-21 | 240 | 950 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 62-86 | <50 | 1,400 | 0.008 |
| 150. 1,2,4-Trichlorobenzene | 65-100 | <50 | 9,000 | 1.24 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. One sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

## Table E-5 (Continued)

## WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

| BDAT List Constituent | Wastes fed to the Rotary Kiln[a] K019 (ppm) | Wastes fed to the Rotary Kiln[a] RCRA Blend (ppm) | Wastes fed to the Secondary Combustor PCB Blend (ppm) | Wastes fed to the Secondary Combustor Mercaptan-Contaminated Waste (ppm) |
|---|---|---|---|---|
| METALS | | | | |
| 155. Arsenic | <0.2-1.2 | 94 | 7.4 | <0.02 |
| 156. Barium | <0.9-0.97 | 1.3 | <19 | 1.67 |
| 158. Cadmium | <0.3-0.63 | <0.3 | <33 | <0.003 |
| 159. Chromium | 1.8-5.3 | 40 | 23.7 | <0.009 |
| 160. Copper | <1.0-3.6 | 165 | 107 | 0.027 |
| 161. Lead | 2.1-3.5 | 27 | <7.3 | 0.0064 |
| 163. Nickel | 2.2-6.0 | 8.8 | 6.2 | 0.037 |
| 168. Zinc | 4.4-9.4 | 4,170 | 6810 | 0.071 |
| INORGANICS | | | | |
| 171. Sulfide | 790 | 830 | 16,000 | 17 |

[a] Six sample sets of K019 were collected; results are presented as ranges, where appropriate. One sample of RCRA Blend, PCB Blend, and Mercaptan-Contaminated wastes were collected.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for K019 (Reference 12).

## Table E-6

## TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

### KILN ASH RESIDUAL

| BDAT List Constituent | DETECTION LIMIT | Concentration in Kiln Ash - Total Concentration (mg/kg)<br>SAMPLE SET #1 | SAMPLE SET #2 | SAMPLE SET #3 | SAMPLE SET #4 | SAMPLE SET #5 | SAMPLE SET #6 |
|---|---|---|---|---|---|---|---|
| SEMIVOLATILES | | | | | | | |
| 70. Bis(2-ethylhexyl)phthalate | 2 | ND | ND | ND | 12 | ND | ND |
| 72. Di-n-butyl phthalate | 2 | ND | ND | ND | 230 | ND | ND |
| METALS | | | | | | | |
| 154. Antimony | 6.0 | 8.0 | 6.8 | 9.2 | ND | 9.1 | 9.6 |
| 155. Arsenic | 0.2 | 3.6 | 2.8 | 5.7 | 5.7 | 3.9 | 2.3 |
| 156. Barium | 0.9 | 26 | 23 | 54 | 8.4 | 21 | 11 |
| 158. Cadmium | 0.3 | 0.66 | 0.96 | 3.6 | ND | 1.2 | 2.2 |
| 159. Chromium | 0.9 | 44 | 60 | 202 | 28 | 125 | 141 |
| 160. Copper | 1.0 | 2370 | 3430 | 2290 | 1270 | 2780 | 2520 |
| 161. Lead | 0.2 | 120 | 42 | 118 | 25 | 86 | 34 |
| 163. Nickel | 2.0 | 66 | 89 | 169 | 69 | 166 | 288 |
| 165. Silver | 0.9 | 3.3 | 3.4 | 1.9 | 2.6 | 3.3 | 3.1 |
| 167. Vanadium | 2.0 | 4.1 | 4.8 | 6.0 | ND | 5.7 | 8.7 |
| 168. Zinc | 0.6 | 12 | 13 | 16 | 11 | 22 | 13 |
| INORGANICS | | | | | | | |
| 170. Fluoride | 2 | 38 | ND | 6.1 | 3.2 | 23 | 4.7 |
| 171. Sulfide | 50 | 68 | 5.1 | 64 | ND | 64 | 92 |

ND - The compound was not quantified at or above the detection limit.

Note: This table shows the concentrations in the kiln ash for all constituents that were detected in the nonwastewater residuals generated from treatment of the waste.

Source: Onsite Engineering Report for K019 (Reference 12).

## Table E-7

## TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019 AND OTHER WASTES TREATED BY ROTARY KILN INCINERATION

## SCRUBBER WATER RESIDUAL

| BDAT List Constituent | DECTECTION LIMIT | SAMPLE SET #1 | SAMPLE SET #2 | SAMPLE SET #3 | SAMPLE SET #4 | SAMPLE SET #5 | SAMPLE SET #6 |
|---|---|---|---|---|---|---|---|
| | Concentration in Scrubber Water - Total Concentration (ug/l) | | | | | | |
| **Volatiles:** | | | | | | | |
| 21. Dichlorodifluoromethane | 2 | ND | ND | 4.3 | 14 | ND | ND |
| 43. Toluene | 2 | ND | 3.2 | 2.6 | 4.6 | ND | ND |
| **Semivolatiles:** | | | | | | | |
| 98. Di-n-butyl phthalate | 2 | ND | 6.3 | 4.6 | 4.2 | 2.7 | 2.5 |
| **Metals:** | | | | | | | |
| 154. Antimony | 240 | 410 | 390 | 410 | 400 | 350 | 320 |
| 155. Arsenic | 2 | 46 | 38 | 30 | 29 | 27 | 33 |
| 156. Barium | 9 | 480 | 500 | 530 | 550 | 600 | 570 |
| 157. Beryllium | 1 | ND | ND | ND | ND | 2 | ND |
| 158. Cadmium | 3 | 230 | 190 | 150 | 130 | 120 | 110 |
| 159. Chromium | 9 | 110 | 140 | 130 | 140 | 140 | 130 |
| 160. Copper | 10 | 1810 | 1380 | 1180 | 1130 | 1030 | 870 |
| 161. Lead | 80 | 820 | 780 | 640 | 600 | 480 | 400 |
| 162. Mercury | 0.2 | 2 | 2.6 | 1.5 | 0.4 | 1 | 1 |
| 163. Nickel | 20 | 81 | 68 | 57 | 65 | 67 | 61 |
| 165. Silver | 9 | 85 | 95 | 92 | 92 | 90 | 92 |
| 167. Vanadium | 20 | 160 | 180 | 150 | 150 | 160 | 160 |
| 168. Zinc | 6 | 11,400 | 11,000 | 9500 | 9980 | 11,100 | 10,400 |
| **Inorganics:** | | | | | | | |
| 170. Fluoride | 10 | 20,000 | 15,000 | 14,000 | 13,000 | 12,000 | 12,000 |

ND The compound was not detected at or above the detection limit.

Source: Onsite Engineering Report for K019 (Reference 12).

## Table E-8

## DESIGN AND OPERATING DATA FOR THE ROTARY KILN AND SECONDARY COMBUSTOR

| Parameter (units) | Design Value | SAMPLE SET #1 | SAMPLE SET #2 | SAMPLE SET #3 | SAMPLE SET #4 | SAMPLE SET #5 | SAMPLE SET #6 |
|---|---|---|---|---|---|---|---|
| Kiln Outlet Temperature ($^oF$) | o | 1825-1900 | 1800-1880 | 1850-1900 | 1775-1900 | 1775-1800 | 1775-1850 |
| Kiln Solids Residence Time (min) | o | 120 | 120 | 120 | 120 | 120 | 120 |
| Kiln Waste Feed Rate (MMBTU/hr) | o | | | | | | |
| K019: | | 13.1 | 12.2 | 12.4 | 12.7 | 11.7 | 11.5 |
| RCRA Blend, Burner #1: | | 3.9-5.5 | 5.2-5.5 | 5.2-5.8 | 5.2-5.8 | 5.2-6.0 | 5.2-5.8 |
| RCRA Blend, Burner #2: | | 4.4-9.7 | 4.4-9.7 | 4.4-8.4 | 4.4-7.3 | 5.2-9.7 | 5.2-9.7 |
| | Total: | 21.4-28.3 | 21.8-27.4 | 22.0-26.6 | 22.3-25.8 | 22.1-27.4 | 21.9-27 |
| Kiln Rotational Speed (RPM) | o | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 | 0.19-0.21 |
| Afterburner Temperature ($^oF$) | o | 2380 | 2400 | 2400 | 2400 | 2400 | 2350 |
| Afterburner Residence Time (sec) | o | 2 | 2 | 2 | 2 | 2 | 2 |
| Afterburner Waste Feed Rate (MMBTU/hr) | | | | | | | |
| PCB Blend: | o | 36.1 | 36.5 | 36.5 | 36.5 | 37.5 | 37.5 |
| Mercaptan-Contaminated Waste: | | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 |
| | Total: | 36.28 | 36.68 | 36.68 | 36.68 | 37.68 | 37.68 |
| Stack Oxygen Concentration (%) | NA | 6.8 | 7.0 | 7.2 | 6.4 | 6.8 | 7.0 |
| Stack Carbon Monoxide Concentration (ppm volume) | NA | NR | NR | 0 | 0 | NR | NR |

o - This information has been claimed RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for the First Thirds Rulemaking of August 17, 1988.

Source: Onsite Engineering Report for K019 (Reference 12).

NA - Not applicable.
NR - Not recorded.

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